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✓ ARE CONVENTIONAL
PATTERNS SPONTANEOUSLY GENERATED? *



IN the pattern ornament of the nineteenth century we may distinguish three classes of designs—first, the pattern which repeats a more or less realistic picture; second, the patterns designed under the conventionalizing methods of the Decorative Art movement; third, the conventional patterns of tradition. It is with these last that the student of the lotus has to deal, but first and foremost he is obliged to say what are the conventional patterns of tradition, and to prove that they are traditional. For it appears that the elementary knowledge of some people is the fundamental ignorance of others, and we have practically heard the assertion from some critics of the "Grammar of the Lotus" that there are no patterns of tradition. According to the *Nation*, for instance: "There is a considerable number of forms so obvious and inevitable that it would be a wonder if they were not nearly universal....certain ones are practically universal, and are reinvented every time an untaught person tries to invent ornament.... Most of these simple elements are found in the ornament of every savage tribe that

has attained a little skill." It is indeed natural to suppose that the simpler a pattern is, the more easily it is invented. The only sophism about this natural supposition is that the simple patterns have never been invented. They have always been inherited. Nature was their original starting point before they became simple. As patterns they represent a habit, not an invention. This is my assertion. The thesis as such is not a new one, although my applications of it to the lotus and to classic ornament mainly are; but we shall see that as far as anthropology has gone in studying savage ornament, it has already worked largely on this assumption. According to the "Primer of Art," by John Collier (Macmillan): "Any natural object could give the starting point for a pattern which would soon lose all resemblance to the thing it originally represented." The picture was reproduced "without regard to the original until the picture became conventionalized into a pattern, which pattern, once freed from the trammels of nature, developed itself according to man's sense of harmony of line and color. This, then, was the origin of decorative art."

I have a very dear and learned friend

* Being the second Paper of a series on the evolution of classic ornament from the Egyptian lotus. See "The Grammar of the Lotus—an Answer to Critics," in October (1892) Number.

who objected to my theory of concentric rings, that he used to make them on a barn when he was a boy, with a pair of dividers. The odd thing is that concentric rings are not found in the art of nations which have been best acquainted with dividers. They have not been used in Europe as an ornamental system since the time of the prehistoric bronze culture, and they are there distinctly derived from concentric rings joined by tangents, which represented spirals. They were not invented, they were evolved. As for the spiral itself, we will consider that later, and its problem is the same as that of the Ionic volute.

The fact is that modern criticism has its own prejudices and its own narrowness. It is very loud in its announcement of the evolution theory, but it is very illogical in supposing that there has been no evolution in the field of ornament. I shall try to show in this paper that it is in blunt contradiction with the researches of its own anthropologists when it asserts that geometric ornament is the initial starting point of primitive man. According to the *Critic*, "Given the tools and an instinct for decoration, geometrical ornament will spontaneously follow"—but when we examine history we find that the earliest ornaments of primitive man were very



Palæolithic drawing on bone.—Bison's Head.

life-like pictures of the mammoth and other animals, the drawings on bone and horn of the Palæolithic Epoch. For the moment let us remember where we obtained our own theory of conventional art, how long we have had it, and how very apt we are to transplant the habits of thought created by it to the art of other days, without authority and without reason. I was speaking of the three classes of patterns in modern use with reference to this very point.

Of the pictorial patterns just specified we may find the most numerous,

accessible and obvious instances in textile fabrics and on wall papers. None of these pictorial patterns have a wide diffusion or a distinct hold on public taste. Their weakness, as far as survival is concerned, lies in their multiplicity and in the demand of fashion and of trade for a novelty. Another weakness is the constant initiation of more and more people into the point of view, which is a matter of course to the educated decorative designer, that the more pictorial a decorative design, the less it is fitted for good decorative results and purposes. Since the days of Owen Jones and his "Grammar of Ornament" the theory and practice of conventional ornament have triumphed wherever thought and culture have made their way. This was a grand reaction for good as against the feeble pictorial ornament of the first half of our century, but Owen Jones omitted to teach his pupils of the Decorative Art Revival one thing, viz.: how the conventional style of design, which he so rightly admired in historic art, had actually developed in historic use. With our own time conventional art is a theory taught by Owen Jones. In historic art it was a result reached by evolution. Since his "Grammar of Ornament" (1856) we have undoubtedly invented a good deal of geometric pattern or highly schematic pattern on theory. We have even taught such invention and the practice of such invention in elementary schools and kindergartens. But do not, oh, man of to-day, be so wise as to imagine that primitive man is taught in a kindergarten. His only kindergarten is the fetic.

Now there are, in our own practice, a vast number of intermediate stages between the purely pictorial patterns of untrained modern art and the conventional patterns of the modern educated decorator; but when we turn to those patterns which are distinctly characteristic of the recent period of theoretic invention, it will also be found to hold of them that they have no lasting future. It will hold also of them that they are too numerous to last, and it may be added that they have not the strength to cope in popular general

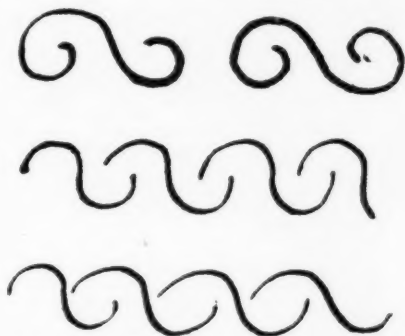
usage with the patterns of tradition. The strength of these last is the strength of tradition, of wide decorative availability and constant use, and above all of the limited number and simplicity of their elementary motives. A still more important element of strength is inherent in their architectural use and in the ascendant power of architectural art over all minor arts of decoration. These traditional patterns are consequently dominant in terra cotta, in tiles, in iron and metal work, and in wood carving, and are copied in color, in fresco and in stamped designs. Moreover these conventional traditional patterns have received a new impulse, and have gained fresh strength from the Decorative Art Revival. As found in the "Grammar of Ornament," and in the similar works of Racinet and others, they have been copied by modern decorative artists searching for a ready-made motive, from the historic plate illustrations of Egyptian, Assyrian, Greek, Arab and Renaissance art. There is no doubt that the plates of these illustrated works have had a much more powerful influence in promoting the spread of the old conventional patterns than their theories have had in furthering the invention of new ones.

It is the limitation in number, the simplicity and the wide-spread modern use of these conventional traditional patterns that has caused the belief that some of them are spontaneously generated whenever and wherever an ornament is wanted. That they are found both in ancient and modern art at remote distances, in various quarters of the world, and at points which appear to us to have been inaccessible to one another is undoubtedly true. That they are universal is not true; that they are common or elementary or indigenous forms in primitive art is not true. That they have ever been spontaneously generated in Europe is positively untrue. I shall show what amount of historic continuity can be proven for them, and when this has been done I think that the advocates of the spontaneous generation theory will admit that its case is very much in suspense, not by any means a matter of

course, and certainly not a case which will justify its advocate in patronizing an opponent.

II.

I do not think it has been suggested that the Ionic capital, the "honey-suckle," or the egg-and-dart moulding have ever been spontaneously generated, but it is the prevailing view that



Evolution of the Guilloche. The two later stages are found on Cypriote vases.

the meander, the various forms of spiral ornament, the guilloche, and the rosette, are "reinvented every time an untaught person tries to invent ornament," and that "they are found in the ornament of every savage tribe that has attained a little skill."* But all seven motives named, and some few other motives, belong to one ornamental system, and have never been used in Europe, apart from historic connections with their original system, since the Greeks, and have never been used in Europe since prehistoric ages, without distinct dependence on the Greeks. As found with the Greeks they can all be traced back to Egyptian sources; except the guilloche, which is only a later variant of the spiral scroll.†

I will not stop now to debate the origin of any of these forms and I will waive the egg-and-dart moulding, as regards even its mention in the Egypt-

* See quotations from the "Nation" in my first article.

† The guilloche pattern has been found in Egypt on pottery dated to the Twelfth Dynasty (3000 B.C.), which was probably made by foreigners resident in the country, but it may easily be an Egyptian pattern which has not yet been specified as such, for want of sufficient evidence in the way of finds.



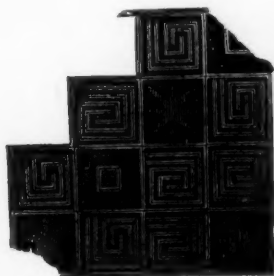
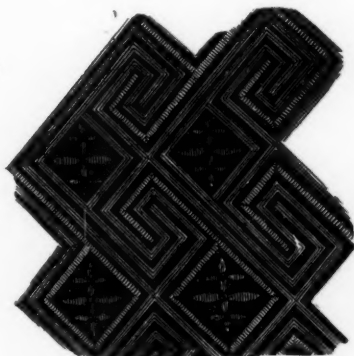
Head of the Lady Nefert, portrait statue of the Gizeh Museum. On the head-band are rosettes between lotuses, dating about 4000 B. C. Neck ornament of lotus buds inverted.



Enamel rosette amulet;
Owens College, Man-
chester. Dating about
3000 B. C.



Scarab with spiral scroll.
Fifth Dynasty (3900
B. C.)



Meanders from a tomb at Siout; about 2500 B. C.

tian category, if any one should desire me to do so, as its motive is only found in Egypt in the form of a flat lotus border inverted. But still let us stop a moment to consider this point of historic continuity for the ornaments named, in block. The Egyptian rosette can be dated to the Fourth Dynasty, 4000 B. C. Since that time its history has been continuous. Since its first transmission to Europe it has never been reinvented in Europe, for there was never an occasion or a chance to reinvent it there. The spiral scroll is dated to the Fifth Dynasty.* That too has had a continuous history since that time down to the nineteenth century, as far as Europe is concerned.

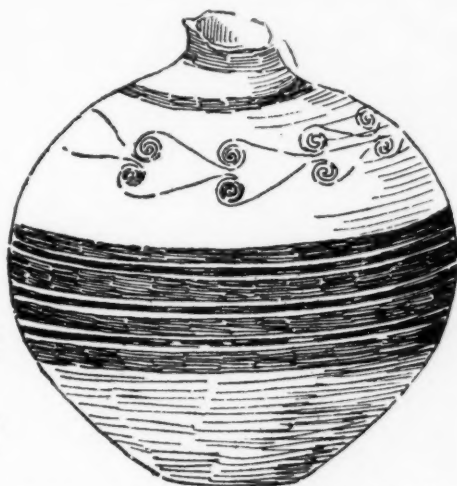
The meander is dated at present to the Thirteenth Dynasty, about 2500 B. C., and the same point holds again for its Euro-



Granite pillars at Karnak. On one of them the Ionic lotus in relief; about 1600 B. C.



Enamel lotus palmette amulet, Owens College, Manchester. Original type of the Greek anthemion; dated about 3000 B. C.



Spiral scrolls on pottery. From the "First Tomb," Mycenae. Schliemann excavations.

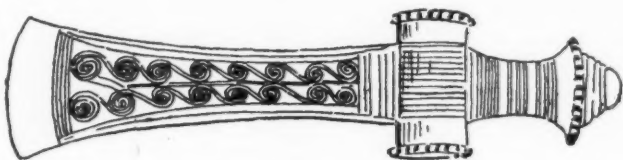
* References and authorities for all dates will be found in the "Grammar of the Lotus," by referring to its index.

pean history after that date. The Egyptian Ionic capital is dated to the Eighteenth Dynasty, 1600 B. C. The Egyptian anthemion ("honeysuckle" original) is dated to the Twelfth Dynasty (about 3000 B. C.) In the various cases mentioned the dates are for the earliest known cases among the very rare instances of positively dated ornaments for very early times, and a considerably higher antiquity than the given date must be assumed in all cases. The lotus border originals of the egg-and-dart moulding are certainly much older than the Eighteenth Dynasty to which we can positively date them.

Some of these ornaments traveled all over Europe in the prehistoric period. None of them, however, appeared in Europe before the Age of Bronze, and they moved with the arts of metal partly by land, partly by Phœnician commerce, from the South and Southeast to the North and Northwest. From the days of the Greeks downward the history of all these forms and patterns is continuous in Europe. In the Middle Age, when classic art was nominally or apparently abandoned, the surface patterns at least are historically continuous. The anthemion can be



Tombstone anthemion, Athens.



Prehistoric Swedish bronze axe, with spiral ornament.

verified for all periods of the Middle Age. The Ionic capital survived till the twelfth century at least. The egg-and-dart moulding can be verified for



Roman anthemion, alternating with remote lotus derivatives. The lower border is a variant of the leaf and dart moulding, with alternated lotus trefoils. Lateran Museum.



Detail of the bronze chandelier at Hildesheim. Anthemions and spiral scrolls of the XIth century.



Ionic capitals at Caen, close of the XIth century.

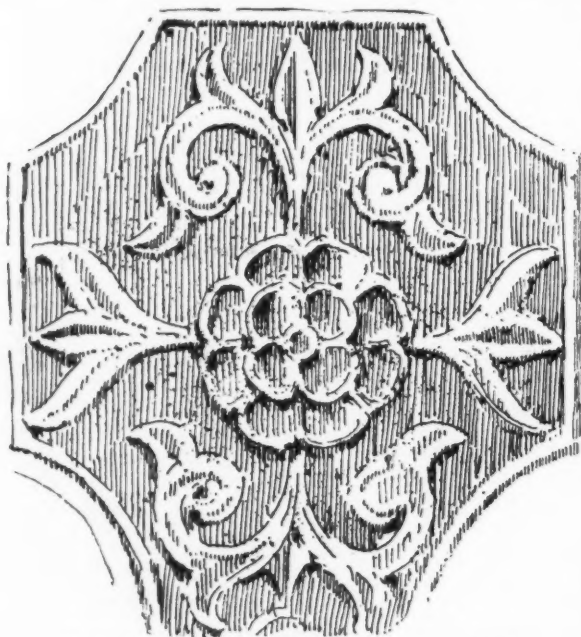
the twelfth century at Arles. The rosette was never given up. The spiral scrolls are historically continuous and the Egyptian lotus trefoil (*fleur de lys*) is a conspicuous instance of continuity.

With the Renaissance period the Greco-Roman motives were all revived,

and many of them had survived without reference to this revival. It is not long between the last days of classic art in Southern France and the first days of the Italian Revival in Pisa. From the time of the Renaissance to the nineteenth century all these motives have been strictly traditional. They have been carried along by the great waves of civilization which have moved from the Renaissance, from the Greek Revival, and from the recent studies of historic art. Their continuity is a phase of the one essential fact of the history of civilization, that man never reinvents anything that he finds ready-made to hand. They met all the natural demands for ornamental patterns. They were passed on, from one decorator and artisan to another, as the matter of course things to do.

Now I urge that the history of ornament in Europe establishes a preliminary presumption that these ornaments when found elsewhere may not have been created independently or spontaneously, and outside the American Continent we have not the slightest difficulty in proving a positive case.

I will now take up successively the patterns for which the



Saracenic lotus trefoils, derived from Byzantine. Algeria.



Fifteenth century Italian lotus trefoils and anthemions, derived from classic models.

claim has been especially made that they "are reinvented every time an untaught person tries to invent ornament." It may be well to mention the Ethnographic Collections on which I base the following statements. They are the New York Natural History Museum, the National Museum at Washington, the South Kensington Museum, the British Museum, the Pitt-Rivers Museum at Oxford, the Trocodéro in Paris, the Kircher Museum at Rome, the Ethnographic Museum of Amsterdam, the Ethnographic Museum of Berlin and the Ethnographic Museum of Leyden. The two last named are the finest collections in the world, and I have made a careful study of their evidence, having examined thousands on thousands of objects to reach my conclusions.

Notwithstanding the enormous num-



Buddhist gold relic casket, Greek style, dated 50 B. C. From the Valley of the Cabul. "The bottom of the casket is ornamented with a beautiful conventional representation of the sacred lotus."

ber of objects from the Pacific Islands in Berlin and in London, the Leyden Collections must be placed first. They are much more comprehensive and sys-

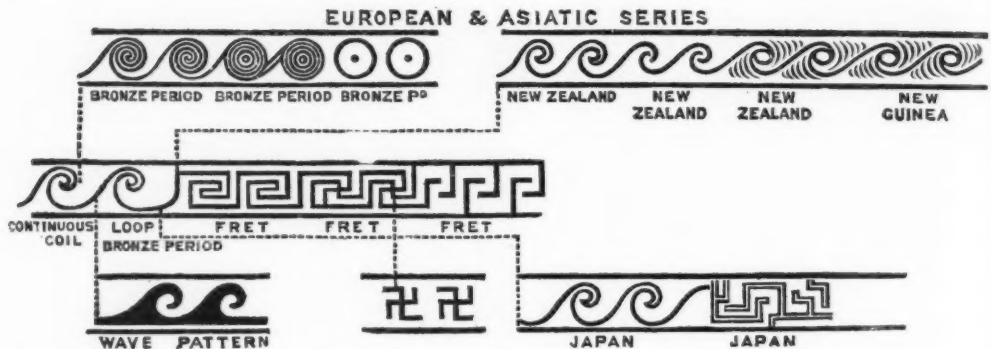
tematic as regards a balanced choice of objects for all local centres, for the Pacific Islands in general, and above all they are connected with a representative exhibit for the Malay Archipelago which is simply unique.*

When these various Ethnographic Collections have been examined it appears that the conclusions obtained for Europe regarding the meander are substantiated. So far from being a universally employed



Silver patera; Greek style, Bacchic subject. From Badakshan.

* Owing to the facilities offered through the Dutch Colonies of the East Indies.



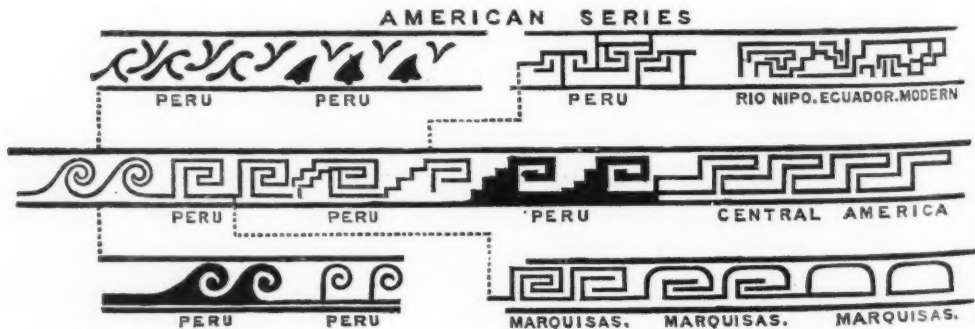
Variants of the spiral scroll and meander, according to General Pitt-Rivers. From John Collier, *Primer of Art*.

or spontaneously generated pattern it is distinctly traditional outside of Europe, as far as we can trace its history. It is unknown to barbaric Africa;* it was not used in ancient Mesopotamia. It is foreign to Mohammedan and Arab art. Its sporadic appearance in Asia, India, Thibet, China and Japan, is due to Buddhist influences. The Buddhist art is the earliest that we know in India (third century B. C.), and at its first appearance is saturated with Greek influences through the Greek states of Bactria founded by the successors of Alexander the Great and through the commerce then actively carried on with the West. These same Buddhist influences by way of farther India would explain its occasional appearance in the decoration of the Malay Archipelago, where it is by no means common. The meander is so rare in Polynesia that the Leyden Collection contains

only two examples* and I have not observed a single other Polynesian instance in the magnificent collections of London and Berlin. In the same exhibition case, with the instances of the meander from the Marquisas Islands, I noticed a necklace made of common *shirt buttons*. This palpable indication of European influence might account also for the meander, and although I am not disposed to insist on the coincidence there are agnostic minds which would—under other circumstances. For instance, if supposed cases of ancient Northman ornament were found in Massachusetts with necklaces of shirt buttons, I think it would be hard to convince the agnostic

* On ivory ear ornaments from the Marquisas Islands. The meander is also quoted for the Marquisas Islands by General Pitt-Rivers, founder of the Oxford Collections known by his name. I have not found it in Partington's publication of Polynesian ornament. As influences from the Malay Archipelago are conceded for the whole of Polynesia, a sporadic appearance has nothing surprising about it. The meander is distinctly foreign to the ornamental systems of Polynesia as such.

* I have notes for one or two sporadic cases.



Variants of the spiral scroll and meander, according to General Pitt-Rivers. From John Collier, *Primer of Art*.

mind that European influences since the time of Columbus did not account for both phenomena in Indian art and throw the Northmen out of court. The Buddhist influences in the Malay Archipelago and the occasional appearance of the meander there would, however, sufficiently explain any sporadic cases in Polynesia. As to the instances of the strange surprises of native intercourse in this part of the world, I think one of the most curious is a neck ornament of *elephant ivory* imitating a *whale's tooth*, from the Fiji Islands, in the British Museum.

As to the appearance of the meander in the ornamental systems of Ancient America, I have personally traced its diffusion, and that of the patterns with which it is generally associated, from the Buddhist art of Thibet and Mongolia through Siberia and the Aleutian Islands as far as Alaska, in modern survivals.* The Mongolian

most conservative students. An interesting illustration of native intercourse in our own days in this quarter of the world is in the Berlin Ethnographic Museum, a girdle of Chinese coins on a native woman's dress, from Cook's Inlet, Alaska.

The Mongolian character of the Pueblo Indians is specified by a recent article in *Scribner's*, which also men-



Chinese pottery anthemion; Buddhist derivative.



Chinese pottery anthemion; Buddhist derivative.



Ancient Pueblo pottery from New Mexico. National Museum, Washington.



Chinese pottery anthemion supporting lotus trefoil; Buddhist derivative.

descent and affinities of the native races of America have been asserted or noticed by many writers.† The theory of the settlement of America by way of Behring Straits and the Aleutian Islands and by way of voyages in the North Pacific is that of the

tions the language of the Navajos as being identical with that of the Tinnah tribe of Alaska. A visit of Chinese Buddhist priests to America in the fifth century A. D. is an attested fact of history.* Buddhist influences in Ancient America are noted by Sir George C. M. Birdwood, in his *South*

*In the Ethnographical Collection of Berlin, which are the only ones of sufficient extent for the Amoor Valley, for the Yakoots and for Alaska. There are also important instances of the Siberian meander at Amsterdam.

†For instance, by the most recent authority on American history, "History of the New World called America," by Edward John Payne, Fellow of Oxford College. According to the London "Academy," "He connects unreservedly the peoples of America with the Mongol or Tartar races."

*See "Fusang, or the discovery of America by Chinese Buddhist priests in the fifth century," by Charles G. Leland.



Spiral scroll derivative from Buddhist ornament. On an Eye-shade from Alaska in Berlin. Author's sketch.

Kensington Handbook on "The Industrial Arts of India."

According to the latest (Ninth) Edition of the *Encyclopædia Britannica*, in its article on the Zodiac: "A large detachment of the (Chinese) cyclical animals found its way to the New World. Seven of the twenty days constituting the Aztec month bore names evidently borrowed from those of the Chinese horary signs. The Hare (or Rabbit), Monkey, Dog and Serpent reappeared without change; for the Tiger, Crocodile and Hen, unknown in America, the Ocelot, Lizard and Eagle were substituted as analagous."

The area of diffusion in Ancient American Art of the ornamental system to which the meander belongs shows a gradual weakening of the motives (as regards adherence to normal forms) and of their frequency, from North to South, between the extremes of Arkansas and Peru, which are the extremes of present excavation of ancient remains in large amount. This is what we should expect on the theory of an introduction from Asia. The recent discovery of Siberian inscriptions in an alphabet resembling the Carian and Lydian of Asia Minor,* found in the valley of the Yenesei, has been supplemented by a still more recent discovery made known to the Ninth Oriental Congress (which met in London in September) by Professor Donner, of Finland, of a Siberian inscription of the eighth century A. D., having Chinese characters on one side of the block and these same characters

of Asia Minor on the others. I personally make known to Professor Donner the inscription of the Grave Creek tablet found in a mound-builder's tomb of West Virginia in 1838, with the result that he specified offhand thirteen of the twenty-three characters as being identical with those known to him from the Siberian inscriptions.

All these various points lead to the conclusion that as long as we can prove an unbroken continuity for the history of the meander pattern throughout the whole world, outside of Ancient America, we are justified in relating its presence there to a similar historic continuity. I am satisfied for the moment to have traced the ornamental system to which it belongs in modern survivals from Thibet through Mongolia and Siberia to Alaska, and I am satisfied to rest my case for the relations of Ancient America with Asia on the following quotation from the most recent author on the "Migration of Symbols," Count d'Alviella, Professor of the History of Religions in the University of Brussels: "It must be admitted that the art of the far East has been profoundly modified by Buddhist types which came from India. As to Ancient America, Gustave d'Eichthal had already drawn attention to similarities which exist between the monuments of Central America and of Buddhistic Asia. For my part I am more and more inclined to admit, not the Asiatic origin of the American populations, but, what is quite another question, the intervention of certain artistic influences radiating from China, Japan, or the Indian Archipelago long before the Spanish Conquest."

* These alphabets were generally abandoned in Asia Minor at least as early as the fourth century B. C.



Greco-Roman ornamental details. From Trajan's Forum. Lateran Museum.

It is interesting to notice that these conclusions of d'Alviella have been largely reached through the study of the symbol called the Swastika, which I have proven in the "Grammar of the

of our spiral scrolls have a Renaissance derivation—that is, they are survivals of fifteenth and sixteenth century Italian copies of Greco-Roman originals, which in their turn are de-



Byzantine well, Venice. Motives derived from the classic; guilloche border above, inverted debased anthemions, spiral scrolls.

Lotus" to have been originally a section or segment of the meander pattern.

III.

In order of prominence among the formal linear patterns which are traditional in nineteenth century use, we may next mention the spiral scroll.* Most

rived from the earlier Greek, and these again are decorative evolutions from Egyptian patterns. When our spiral scrolls are not Renaissance, they are copies dating from the Greek Revival of the late eighteenth and early nineteenth century, or they are copies taken by recent decorators from the recent publications of historic decorative art. The theory of spontaneous generation, the supposed natural aptitude of any one who has "tools and an

* I have not drawn any distinction in this paper between the purely linear spiral scroll and those which bear foliage and flower details. The evolution of these last from the lotus spiral belongs to the later Greek art originally.



Byzantine capital, Ravenna. Details derived from the classic.

instinct for decoration"* for making spiral scrolls without reference to tradition, shipwrecks utterly when brought face to face with historic facts as far as Europe is concerned. Tradition is not only the rule but it is a rule without exceptions.

Theorists and reviewers (who are generally more than twenty years old) can sit down at a desk and design a spiral scroll on the writing pad which will carry their article to the press. They will then announce on the same writing pad that any child can do the same thing, and that primitive man can do, and does do, anything that a modern civilized child can do. But somehow it happens that reviewers and children who have grown up, or are growing up, surrounded by the originals of the forms which they fancy themselves to be inventing, are not the people who are called upon to design decorations for the market. Decoration is a trade which presupposes, like all

other trades, a special education and compels it. This education is either traditional, that of the artisan—say a stove maker—who recasts an old pattern with or without slight modification—or it is special, the education of an architectural school or a school of decorative art where the pupil is surrounded by historical examples whose influence comes to the same thing.

The question is not whether a person who braces himself up to answer Mr. Goodyear's theories could not invent something new in the way of a spiral, but the question is whether before the time of theoretic instruction in decoration, which never existed before 1850, anybody who was an artisan decorator ever did brace himself up to do such a thing. When the question is put in this way the argument is all on my side to any one who knows anything about the history of ornament.

As a matter of fact, under normal conditions, wherever and whenever a

* See quotation from the "Critic," in my first paper.

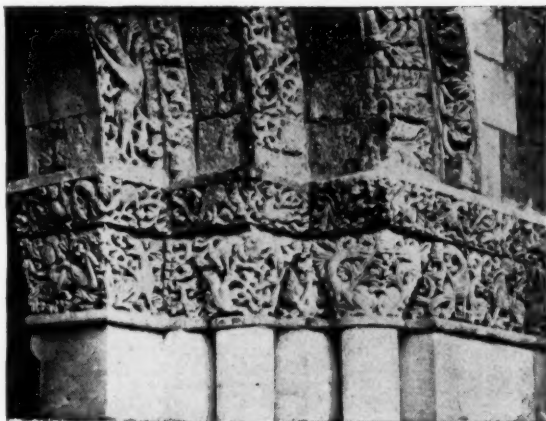


Romanesque anthemions and spiral scrolls. Detail of the bronze chandelier at Hildesheim, XIth century.

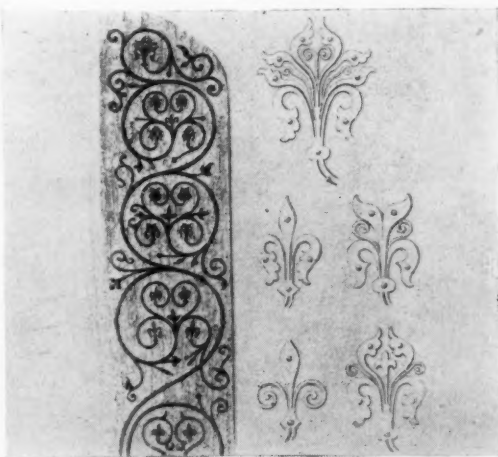
new departure is made in ornament, that new departure will be from a *natural form* or a natural phenomenon. Where the pattern is abstract, schematic, or apparently purely linear, that pattern will be a traditional survival of a form which was once also a form of nature, and the modifications made in it will have been gradual and evolutionary.

I am speaking now of the spiral scroll especially, and having asserted that all our motives of this character are fundamentally classic, and Egyptian before they were classic, I wish to speak of the spiral scrolls of other ornamental systems—mainly to say that, like the snakes in Ireland, there are none—none that is that are not derived from the system under discussion.

We have seen already that the earliest Hindoo art known to us is Buddhist under Greek influences,* and we must turn now to the "Moorish," or, more correctly, Arab Mohammedan system, to notice that this also is of ultimately classic derivation. Aside from Persian influences on Arab art, which again go back to the



French Romanesque details derived from Byzantine (St. Amand de Boissée).



English Gothic details, derived from Romanesque. Iron-work of a church door.



Italian XVth century detail; direct revival of the classic.

*There are indications that Persian and Assyrian influences in India preceded the Greek, but as far as dependence of their forms on Egypt is concerned the argument is the same.



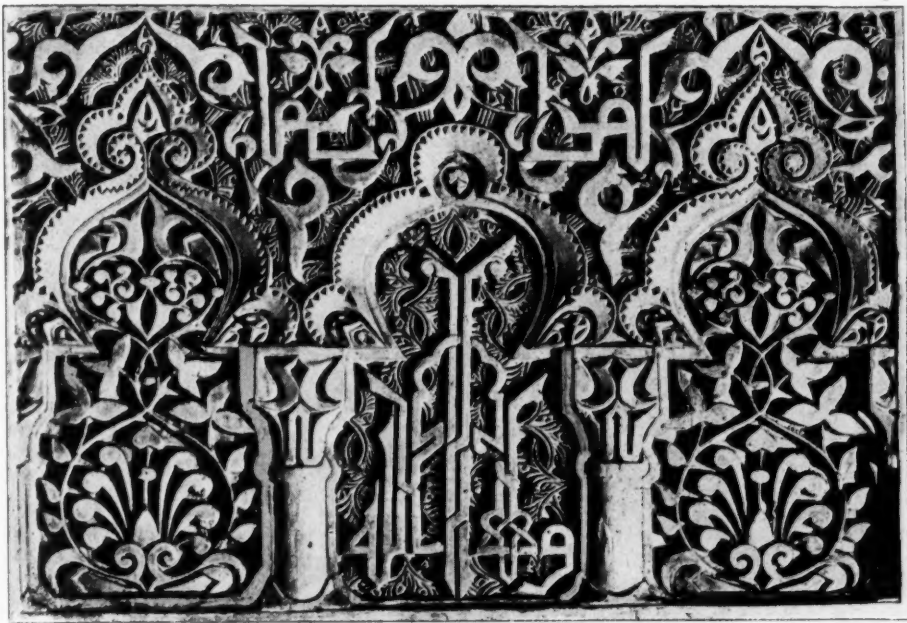
Modern glazed Sindh pottery. Traditional pattern of inverted lotus buds and trefoils, derived from the classic.



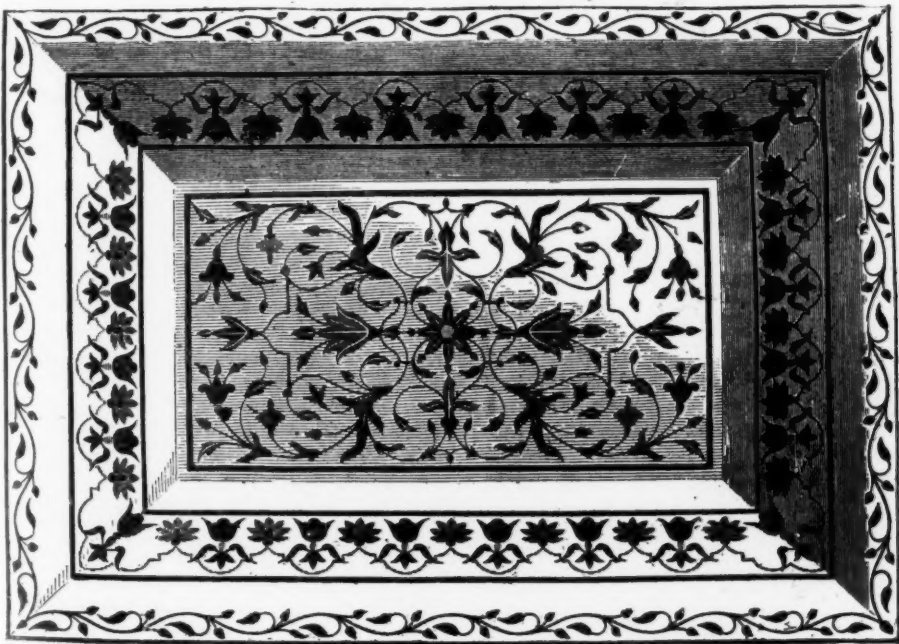
Modern glazed Sindh pottery. Traditional Mohammedan pattern; inverted lotuses.



Arab capitals of the Alhambra. Motives derived from Byzantine.



Arab detail from the Alhambra. Motives derived from the Byzantine.



Inlaid work of Agra. Traditional Hindoo lotus patterns (Mohammedan and Persian) derived from classic.



Shield, damascened in gold; Panjab. Traditional lotus patterns derived from classic.

same original elements,* Arab ornament was derived from Syria, Egypt and North Africa (all of which were Byzantine [Roman-Greek] provinces) in the seventh century A. D., and at the time of the Mohammedan conquest of these countries from the Byzantine Empire. The dependence of the Arabs on Byzan-

tine culture has been well explained by Mr. Freeman in his lectures on the Saracens and is otherwise a commonplace of the average historian. All the Arab and Mohammedan spirals (generally with lotus trefoils) are modifications and evolutions from the Byzantine Greek. If you will turn now to a map of the area of the Mohammedan religion, which means Mohammedan art

and culture also, you will find it reaching in Africa from the shores of the Mediterranean to the River Gambia, to the Niger, to Lake Tanganika, and to Zanzibar.*

In Asia we find the Mohammedan



Tinned brass bowl, incised; North West India. Traditional patterns derived from classic.

* See map published in "Islam and its Founder," by Stobart Society for Promoting Christian Knowledge.

color spreading from Arabia, Asia Minor and Persia through Turkestan into Siberia as far as the River Ural, as far as Tobolsk, as far as the Irtish and the Obi. We find the Mohammedan color spread over India, in the Peninsular of Malacca, and the Malay Archipelago, Sumatra, Java, Borneo, and the Celebes. Now let the reviewers who assert the spiral scroll to be one of the natural ornaments of barbaric man consider the point that it does not occur in barbaric Africa at all, excepting in cases of palpable Moorish or Arab art. I have seen it, for instance, on some very rude brass vases of Moorish design from the Niger, in Berlin.

Otherwise it does not occur in the Niger or the Congo country or in other parts of barbaric Africa.* The Somali and Abyssinian ornament is of course Arab.

If we turn to the Malay Archipelago, as compared with Polynesia, the case for the historic traditional continuity of the spiral scroll becomes a certainty. It is here that the Ethnographical Collections of Leyden come in play, the only systematic and complete Collections for the Malay Archipelago in the whole world. Let us remember now that the ornamental system of India was in the first instance, as known to us—Buddhist, under Greek foreign influences as explained; second—Arab Mohammedan. The spiral scroll ornament of modern India is a mixture and survival of the two. (The more formal classic style of old Buddhist ornament has disappeared in India.) This is the ornamental system of the Malay Archipelago. One of the most astounding monuments of Buddhist



Top of a Dyak coffin, Borneo. Mohammedan Malay patterns derived from India.

*The best collections for Africa are those of Berlin and Rome (Kircher Museum).



Mohammedan Malay lotus spirals on a Dyak scabbard from Borneo. Author's sketch, Brit. Mus.



Lotus spirals, Mohammedan Malay system. Design on paper cloth from the Islands of Ternate and Tidore, near New Guinea. Author's sketch, Leyden.



Barbaric scroll patterns derived from the Mohammedan Malay system. On a wooden shield from the Island of Ceram, Malay Archipelago. Author's sketch, Leyden.



Barbaric lotus pattern, derived from the Mohammedan Malay system. On a wooden shield, from the Islands of Ternate and Tidore, near New Guinea. Author's sketch, Leyden.

architecture is the ruin of the temple of Boro Boeder on the Island of Java. The present ornamental system of Malaysia is mainly the Mohammedan Arab. The Malay alphabet, the Malay ornament, the Malay religion, and the Malay culture are all derived from India. Now let the theorist, as to the innate ornamental habits of primitive man, consider that the spiral scroll is absolutely foreign to the ornamental systems of Polynesia, of which there are several. The limit of the spiral



Lotus trefoil pattern, derived from the Mohammedan Malay system, from the Islands of Ternate and Tidore near New Guinea. Author's sketch, Leyden. Compare the Saracenic pattern from Algeria.

scroll Eastward in the Collections of Leyden is the Admiralty Islands, bordering on New Guinea, which is part of Malaysia.

In the Admiralty Islands it is sporadic. In Leyden there are only two instances. In the Berlin Collections the sporadic cases of the spiral are found in other islands also adjacent to New Guinea, Southeast of the Admiralty Islands. Considering that the whole of Polynesia is conceded to have experienced influences from the Malay

Archipelago,* we should not be startled at the sporadic appearance of spiral scroll ornaments farther East than the Admiralty Islands, but since I have reviewed the Polynesian Collections of New York, Washington, London, Amsterdam, Berlin, Oxford, Paris, Rome and Leyden, and the publication of Partington for Polynesian ornament, I am willing to rest my case with the simple statement that the spiral scroll is foreign as such to all the ornamental systems of Polynesia, and that the system of the Malay Archipelago is the Mohammedan Arab, which is derived from Byzantine Greek.

There only remains the case of New Guinea and New Zealand. Not only does New Guinea border directly on the Malay Islands, but it is geographically part of Malaysia. The princes of the Island of Tidore have actually been the potentates of the Northern Coast of New Guinea. The New Guinea ornamental system shows degraded and barbaric forms of the Mohammedan spiral scrolls of Malaysia. From these once more are derived the spiral scroll ornaments of New Zealand.†

*The whole of Polynesia is known to have been peopled from Malaysia. Dr. Serrurier, Director of the Leyden Ethnographic Museum, tells me that many Polynesian peoples emigrated from the one Island of Beroe in the Malay Archipelago. These emigrations are supposed to have occurred before the introduction of the use of metals and consequently of Hindoo culture, but later influences are unquestionably implied in the original fact.

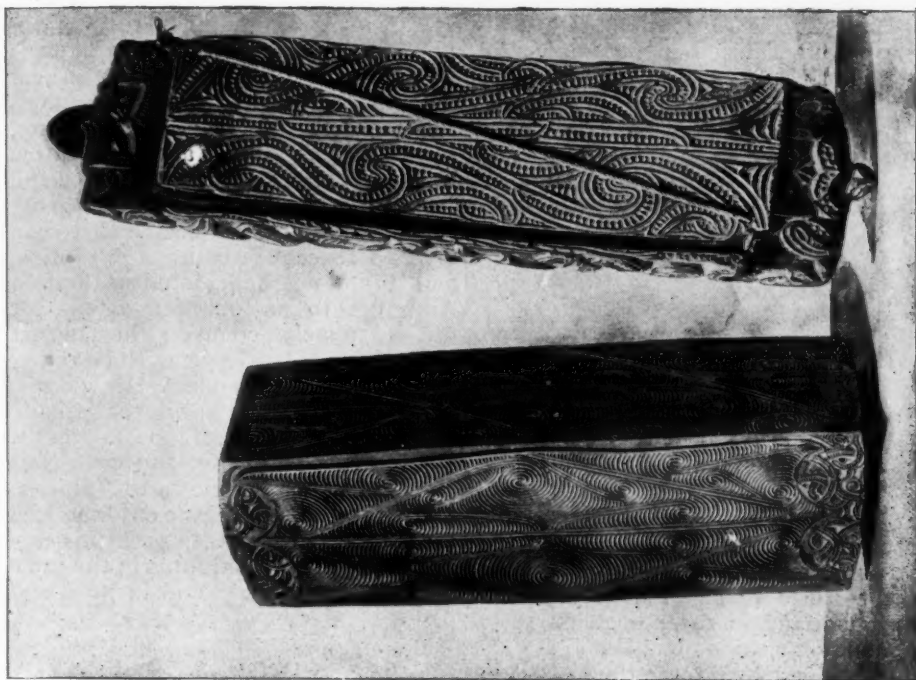
†This statement is the result of personal comparisons and observations, but I have the assent of Dr. Serrurier, Director of the Ethnographic Museum of Leyden, to its probability and reasonable nature.



Ornament of a Malay ship. Direct copy from the Dutch Renaissance. Author's sketch, Leyden.



Idol and wooden pillow from the Northwest Coast, New Guinea. Barbaric ornament derived from Mohammedan Malay. British Museum.



Wooden boxes for holding feathers, New Zealand. Ornamental system derived from New Guinea. British Museum.

The Maoris are supposed emigrants from Tahiti, but the ornamental system of New Zealand has no relations with this supposed earlier home of the



Ancient Pueblo pottery, New Mexico.

Maoris. It will show the possibilities and surprises of intercourse in this part of the world to say that a Japanese bell was found in the possession of the Maoris, which had been in New Zealand before the time of the first European settlers. My informant is Dr. Codrington, the great authority on Polynesian and Melanesian languages.

Now let us turn to the evidence of the Berlin Ethnographical Collections, which are simply marvelous in the mass and comprehensiveness of their material for the areas below named. Once more, and this time through Buddhist transmission, we can trace the spiral scroll from the Amoor valley; where the ornamental system is as familiar to us as that of the Malay Archipelago; through the Yakoots of Siberia to the Aleutian Islands and Alaska. At this point I leave it for the present—referring for Ancient America to the remarks previously made on the meander.

IV.

I have re-examined, last Summer, in the museums of Berlin and Leyden and in the Pitt-Rivers Collection of Oxford, the question of the spontaneous generation of the rosette, with the following conclusions: The area of this ornament

is far more limited than the area of those just considered. In modern use it is historic and traditional. In ancient European use it was limited to Mediterranean countries and their influences, originating in Egypt and transmitted to Mesopotamia, Phenicia, Greece and Italy. Its use was more and more limited in the later Greek and Roman art, and consequently in the Byzantine, and I am not acquainted with it in Arab use to any marked extent. It was extremely common in ancient Buddhist art, but appears to be rather more limited in modern Hindoo survivals. It is unknown to barbaric Africa and unknown to Polynesia, unknown to New Zealand and New Guinea, mainly unknown to Malaysia. Its rare appearance in Ancient American art must be classed with problems suggested by the normal lotus in the same art, in stone carvings and in gold, and



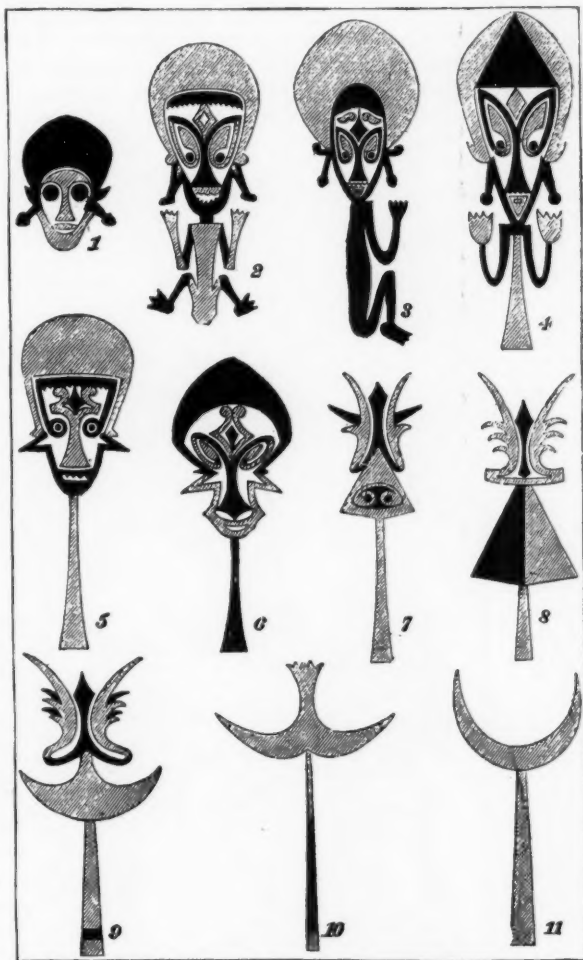
Sindh lacquered box, traditional pattern of rosettes.

I think can only be explained by direct transmission from the ancient Mediterranean world.* There is no pattern of which it can be asserted with so little reason, or show of reason, that it is common and natural to all barbaric and primitive peoples; for it does not appear to be common or native with

* I have offered in the "Grammar of the Lotus" some of the evidence in favor of Phenician voyage from the West coast of Africa to America, in ancient times. I have a sketch of a gold repoussé Ionic lotus in the ancient Mexican Collection of Berlin which is positively unmistakable in its Egyptian identity. I have already published a series of these ancient American lotus patterns, in the work referred to.

any. The rosette is an obvious combination for modern kindergarten scholars who are taught to make elementary geometric patterns and to use petals of flowers and floral forms as suggestions for geometric combination—but I do not care to have my case damaged by an appeal to the kindergartens. I prefer to appeal to history and to the ethnographical collections of the world.

I would recommend above all to inquiring minds on this general subject of the continuity of the historic patterns, a study of the ornamental systems of the Pacific, as showing what barbaric man really does do and how many different things he does, when he is left to his own ornamental instincts without the extraneous influence of a superior civilization. A natural appearance or phenomenon of some kind or other appears to be the invariable starting point. As the pattern itself then becomes a tradition and the point of departure for a new copy, this is gradually simplified until all semblance of the original is lost. The human figure or some portion of it was undoubtedly, in many cases, the initial form. In the Pitt-Rivers Museum, at Oxford, there is a series of paddles showing the gradual transformation of a human figure carved upon them, into a crescent supported by a bar. There is also the case of a fish head used to decorate the junction of the paddle blade with its handle, which finally degenerates into the shape of a capital letter W. There are multitudes of these designs which cannot be explained for want of the connecting links or of the originating form, but I believe it is the conviction of experts in this department, that a purely arbitrary or ideally schematic form was rarely or never the first ele-



Evolution of a pattern derived from the human figure, on paddles of the Pacific; according to General Pitt-Rivers. From John Collier.

ment of the pattern. The introduction of different colors in weaving or basket work, to produce diaper patterns, would perhaps be the only exception to this rule. That the figures of men, fish, animals and birds, which originated patterns, were fetiches and totems, that is to say religious emblems or rather talismans, may be always taken for granted.

The following positions have been established or taken in my two Papers thus far. First: inside the Egyptian system the normal* lotus asserted such

* By the word "normal" I mean a lotus pattern or picture which is visibly a lotus to an Egyptologist or specialist who has *not* examined the purely conventional evolutions of the plant.

an ascendancy as to abundantly account for any evolutions into schematic patterns for which fair evidence is offered. Second: outside of the Egyptian-Greek systems and its developments none of

choice from the series arranged by Mr. John Evans in the Pitt-Rivers Museum at Oxford to show the degradation* of the gold stater of Philip of Macedon as copied by the



Canoe ornaments, Southwest Coast, New Guinea; contrasting independent barbaric art with Malay influence. British Museum.

the patterns known to the Greeks have ever been independently developed. Third: the evidence of Polynesian ornamental systems proves that an absolute dissimilarity between the thing originally represented and the ultimate form of a pattern is an elementary fact in the evolution of patterns.

On this last point I feel disposed to insist a moment longer. In the series of coins herewith we have a

ancient British, which began with a head of the king and terminated in the transformation of a wreath into a sort of cross. The steps of evolution (or degradation) are much clearer when more links of the series are illustrated, the forms shown being copied from a cut in the "Primer of Art," by

* The word is used in a geologic, not in an invidious sense.

John Collier, which was given me by Mr. Balfour, the Curator of the Pitt-Rivers Museum. The fact, however, of this evolution has never been doubted by any one who examined the evidence. Parallels are also found in the history of the alphabet. The letter M is derived from the hieroglyphic picture of an owl. The letter A is derived from the hieroglyphic picture of an eagle. The letter L comes from the picture of a lion, the letter H from the picture of a sieve, the letter F from the picture of an asp. We do not find the slightest resemblance between these objects and the alphabetic signs which are derived from them, and yet we all acknowledge the derivation

living on the Hudson during the Colonial period, which was decorated with the words "Public Notice." These words had been copied by the Indian owing to their frequent appearance on the Colonial sign-boards addressed to trespassers. He could not read them, but his respect for the civilization which furnished him with gunpowder and rum led him to regard their frequent appearance within the limits of this civilization as something suggestive of importance and consequently of decorative availability.

There is an analogous case in the Leyden Museum, where the model copy of a Malay pirate vessel, armed with European cannon, has on the sides of



Evolutions of the Macedonian gold stater design, as copied by the ancient Britons.
As arranged according to Mr. John Evans in the Pitt-Rivers Museum, Oxford.

when the successive steps of transformation are shown.* I once wrote the French word "*jugera*" in a manuscript and it was set up by the printer as "*pigern*," and I could not deny that the word as I had written it was accurately reproduced by the type-setter. We might find many parallels to the problems offered by pattern ornament in the hieroglyphics of some modern penman. The transformations in question are much more rapid and surprising when a foreign nation is the copyist. In such cases the foreign imitator is always subject to the influence of a superior and ascendant civilization, and being both foreign and inferior misunderstands and miscopies accordingly. This was the relation of the Greeks to the Egyptians in the Second Millennium B. C.; this is the relation of the spiral scrolls of New Guinea to those of the Malay Archipelago.

I have been told by Professor W. R. Ware of a platter made by an Indian

its prow a scroll pattern distinctly copied in minor details from the Dutch Renaissance. I noticed a collier canal-boat in one of the Leyden canals, just outside the Museum, which had the identical pattern in the identically corresponding place. The canal-boat had derived the pattern traditionally from earlier and more important Dutch vessels and Dutch East India traders. From these the Malay had borrowed it, because he obtained originally his powder and cannon from the Dutch. The curious point of this instance is that the general motive of the same pattern had reached the Malays by way of India, through Mohammedan art, derived from Byzantine. The Dutch pattern was derived from Spain and Italy, which latter country had taken it from Roman ruins. In this particular instance points as far removed as Holland and the Byzantine provinces of Egypt and Syria—periods as far removed as the time of Mohammed and the Dutch sixteenth century Renaissance—had both transmitted to the Malay Archipelago a design which can

* Isaac Taylor, "The History of the Alphabet."

be found on modern Dutch canal-boats and on the temple ruins of the Empire of Alexander the Great, and which is historically traceable in both cases to the culture influences of Egypt.

Historically speaking, all copying of art forms results from historic waves of civilization, which carry with them comforts and improvements in material living which are of use to the copying people. This holds especially of the diffusion of the arts of metal. It is highly probable that these have traveled from one original centre over the entire world. In other words, trade and commerce are the essential factors of the problem, and the history of ancient ornament as traced to Egypt is really the history of commerce and of civilization. The ascendancy of the superior civilization manifests itself in various exterior ways, of which the copying of forms of art is generally the most obvious, and the most lasting, *as regards the question of evidence*, but the main factor must always be essentially the civilization itself. The prehistoric "Bronze Age" of Europe copied its

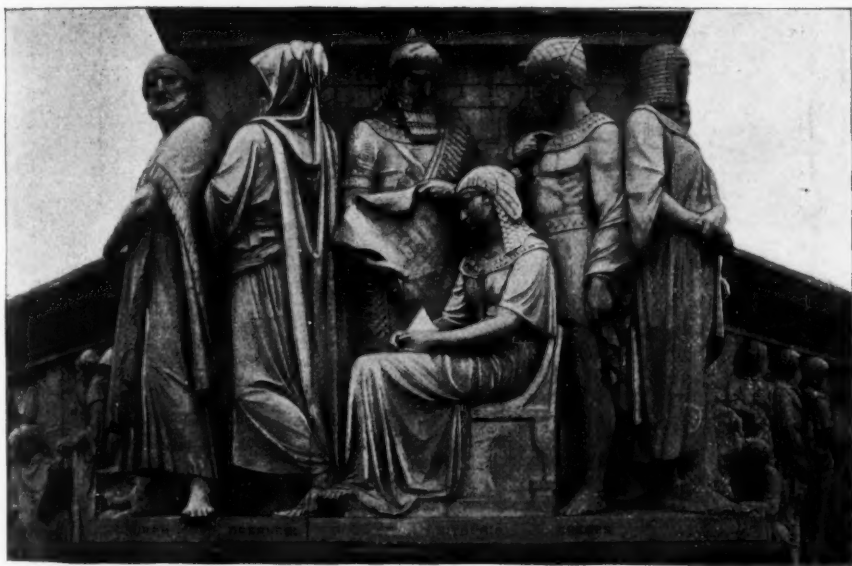
prehistoric patterns from the South and South-East, because the arts of metal, displacing the use of stone implements, also spread from this quarter (according to my contention). What the Greeks were really learning from Egypt in the Second Millennium B. C., was the arts of civilized life, but the evidence of the commercial intercourse survives in the lotus patterns which the commerce carried with it.

I have thus devoted two Essays ostensibly to the ornamental evolutions of the lotus, one of which (the first) offered no proofs for any evolutions whatever, while the second has related entirely to the historic continuity and traditional survival of certain patterns, as opposed to a theory of the spontaneous generation of the same, and as to the origin of these patterns I have said nothing. However, the most difficult part of my task is done. Within the limits of Greek and European prehistoric art, it is a question of proofs which are very easily offered, and which to my mind are perfectly convincing. I shall approach these in my next Paper.

Wm. H. Goodyear.

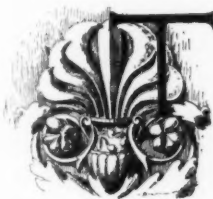
(TO BE CONTINUED.)





Group, from the Albert Memorial, London.

THE INFLUENCE OF THE EARLY RENAISSANCE ON SCULPTURE.



THE art of sculpture has had a checkered career, nor can the contemplation of its past history gratify the pride of the English race, to the same degree as that of architecture and painting.

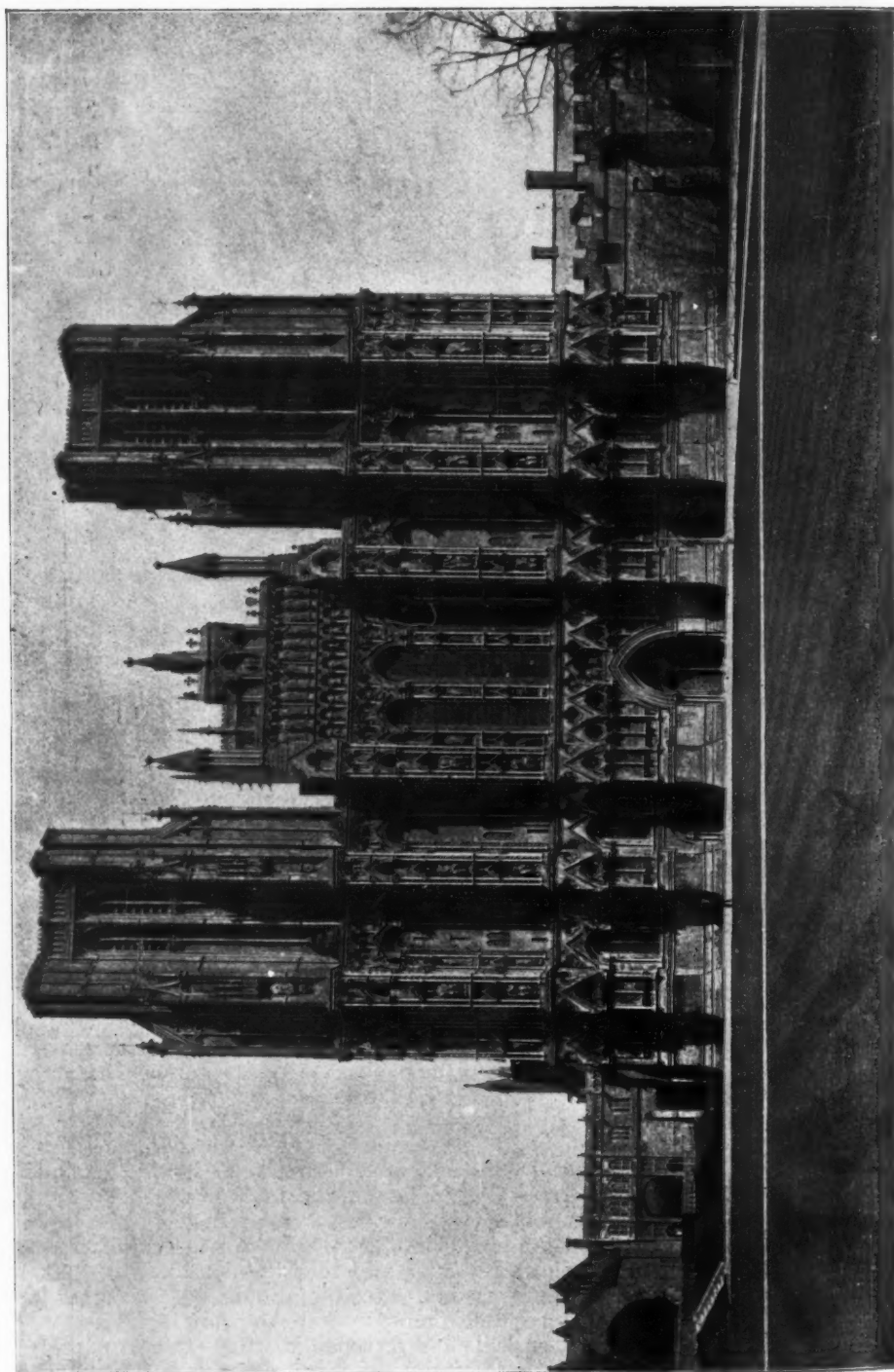
To seek out in detail the reasons for this inferiority would carry us beyond our present purpose, which is to look no farther back than will justify our hopes and expectations for a more glorious future, which will be affected by that same development of the early Renaissance which we have already traced in our architecture. In a striking passage in Mr. Symond's "Art of the Italian Renaissance," is set forth the idea that while the art of the Pagan world was sculpture, that of the Renaissance was painting, and that of the modern will be *music*.

This thesis he supports by arguments drawn from the religious changes of the

world, setting forth that Christian ideas, being abstract and of the soul rather than of the body, could not be adequately expressed by sculpture, which he holds to be incapable of expressing the emotions, beyond certain elementary stages.

He then shows that painting has a wider scope and was equal to the thought of the Renaissance, but that the increasing abstraction of modern ideas has passed beyond this stage, and thus music, with its double character, "La musica e il lamento del amore, o il preghiera dei Dei," and its universal message, appealing to all nations, irrespective of language, is the predominant art of the modern world.

Now, to this exclusion, as it were, of sculpture from a future and from the expression of Christian ideas, he makes one exception, namely, the class of tombs, for here the now soulless body has returned to that state of peaceful calm and repose which the Greeks found so essential to sculpture, and we shall see in our brief review of English



WEST FRONT, WELLS CATHEDRAL.

work how large a place is filled by the class of monuments and tombs.

If in England we have had no Michael Angelo in sculpture the cause is that we have had no Nicola Pisano. No art in England is so entirely imported; architecture in all countries has roots in the soil, but sculpture and painting are far more external. Now, of the Roman remains found here sculpture forms an insignificant part, several rudely-carved altars and tombs being the most important objects. Moreover, the religion of the Druids does not appear to have been idolatrous, and Stonehenge contained no idol. When Nicola Pisano started the revival of art in Italy the classic sarcophagi and vases in the Campo Santo at Pisa were the sources of his inspiration, but our sculptors had to borrow from France, along with the elements of Gothic architecture, the means of producing the wonderful semi-architectural sculpture of Wells and Lincoln.

It is an unfortunate necessity of the modern state of sculpture that we are compelled to distinguish between pedestal and architectural sculpture, that is, between statues and other work, intended to be complete in themselves, as opposed to sculpture intended to group with and form part of the architecture of a building.

It is safe to assert that there are no examples of importance of pedestal sculpture of the mediæval period in England, for our tombs even have a large element of architecture, as in the well-known Bridport Tomb at Salisbury and as in those of the Tombs in the choir at Westminster Abbey, where the relations of Henry III., the royal builder of the choir, repose in shrines of purest harmony with the sacred edifice. In fact, we may say that mediæval tombs are miniature buildings containing panels and spandrels ornamented with sculpture.

But, valuable as are the lessons taught by them and by the wondrous façades of the cathedrals at Wells and Lichfield, both as to the distribution and harmony of architecture and sculpture and as to the extent to which liberties must be taken in treating figures at such

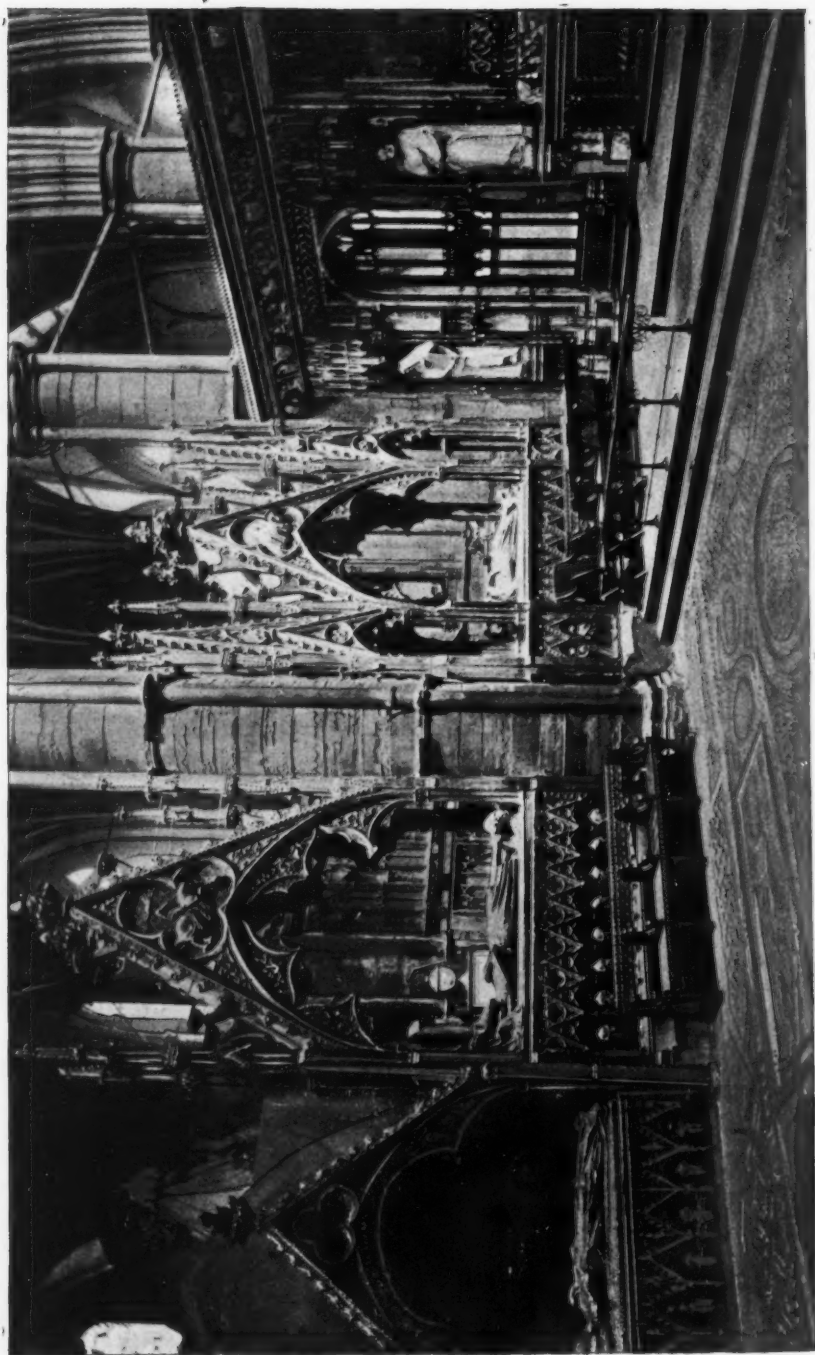
an elevation, still we cannot say that we had advanced very far in sculpturing the figure. The famous angel choir of Lincoln shows work of a higher quality, the spandrel angels are designed in powerful lines of contrast to the spaces they occupy, and have a dignity of purpose and expression worthy of our respectful admiration.

A still higher level is reached in the Angel of the Annunciation from the entrance side of the octagonal Chapter House of Westminster Abbey, where "Christ in Majesty with Angels attending" occupies the quatrefoil of the entrance arch, flanked above by the Madonna and this Angel, in upright trefoil-headed panels on either side. Its dignity and simplicity will recall to our readers the best French work of Notre Dame and of Rheims, and must be ascribed to the same French influence which so largely shaped the characteristics of the Abbey.

An architect is naturally inclined, perhaps, to dwell too long on these great works, while a sculptor, jealous of the qualities of his art, independent of Architecture, sees too often only a want of anatomy and grace, rendering them insignificant beside Greek and Italian statuary, and so no art has been so much studied abroad as sculpture. Flaxman, Gibson, Chantry and others, down to Alfred Stevens, in our own day, all spending long years in Italy mastering the secrets of their art.

We find, however, a high development of architectural sculpture within the possibilities of the knowledge then possessed in England, in the numerous tombs, often perfect gems of art, which exist and were still more numerous formerly in our cathedrals. The lamentable destruction of many shrines, tombs and images during the Reformation and Puritan times has deprived us of many masterpieces, and the effects of these movements were long, and are now felt in a prejudice against the use of sculpture for the highest ends.

Before, however, the events alluded to above, came the beneficial influx of Italian ideas and artists in the reign of Henry VIII. Chief of these artists was Torrigiano, contemporary of Benvenuto Cellini and Michael Angelo.



CRUSADERS' TOMB, WESTMINSTER ABBEY.

How he broke the nose of the latter in reply to an unfavorable criticism of his works is well known, and may serve to caution us in our remarks later on.

In his most valuable and curious biography, Cellini tells us how he refused to go to England with Torrigiano on account of this very fracas, which caused him to hate violently the base insulter of his hero, Michael Angelo. It is true he also detested "*Questi diavoli d'Ingresi*," but he did not all the same get on any better with the French, and had he come to London, instead of to Paris, our art might have greatly benefited. Much of the work of that period was unhappily lost when Henry VIII.'s favorite palace of Nonsuch was destroyed. It was a timber building filled in with plaster panels containing some hundreds of single figures in low relief. Any one who knows Italian Art will realize what a glorious work it must have been; when deprived of their accustomed marble the Italians applied their wonderful gift of low relief sculpture, with the greatest effect to the facile plaster. We have, however, a masterpiece by Torrigiano in the marble and gilt bronze Tomb of Henry VIII. in his Chapel at the East End of Westminster Abbey; this work, inclosed in its grille, forms one of the most complete examples of the early Renaissance applied to Tombs; the stately pomp, but pious treatment of the King and Queen shows the transition between the devotional simplicity of the mediæval and the vain-glorious pomp of the later Renaissance treatment of man's last resting place. Torrigiano also executed other tombs, using the same black polished marble and gilt bronze with a similar style of detail.

Now it has been said that the next great sculptor in England was Alfred Stevens. We cannot, however, make quite such a jump as that, for we have to allude to the great group of Elizabethan and Jacobean tombs, from the best of which, indeed, the later sculptor derived the leading idea of his masterpiece, the Wellington monument.

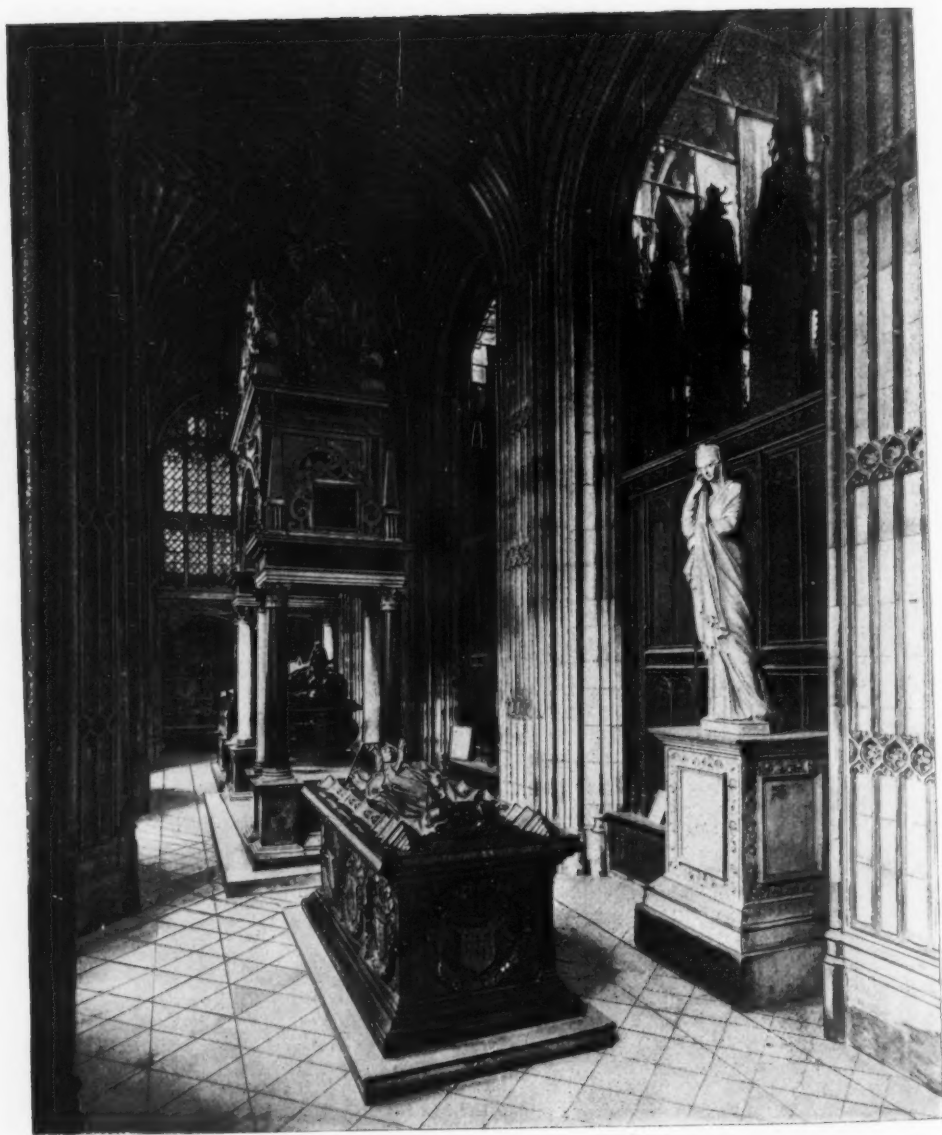
It is to the filial piety of that amateur

of Art and Learning, James I., that we owe the tombs of Queens Mary and Elizabeth and also that of his mother, Mary Queen of Scots. It was a characteristic stroke on his part to bury three Queens in two tombs, but we need not complain, seeing how good the two are.

The stately canopy of pure classic orders and details shows the advance that Italian ideas had made by that period, and the general shape recalling a triumphal arch seems not inappropriate for the Christian who has conquered death by dying, and is resting in calm repose beneath the Tabernacle, his face turned to the coming dawn. These two tombs, however, are above the level of the Elizabethan tombs in general, even that in the background, to which we shall now allude. Its detail and execution are more advanced than others—delightfully quaint and naive, where father and mother and diminishing row of children, all in their everyday clothes, quaintly colored in brightest tints, kneel piously praying for that mercy they seem to us surely to have gained. The Norris family at least claim our sympathy; their tombs in the background show us father and mother and six kneeling stalwart sons, five of them clad in armor as they died on the field of battle, for king and country, and a sixth, beardless alone of all the group, with cheerful uplifted face, as became the survivor of such a family, active and vigorous, rejoicing in existence, untroubled by the cares and doubts with which we spoil our often purposeless lives.

Here then we reach the summit of our ancient art, and crossing the Puritan gap we must reascend to the level to which our modern artists have carried us at present.

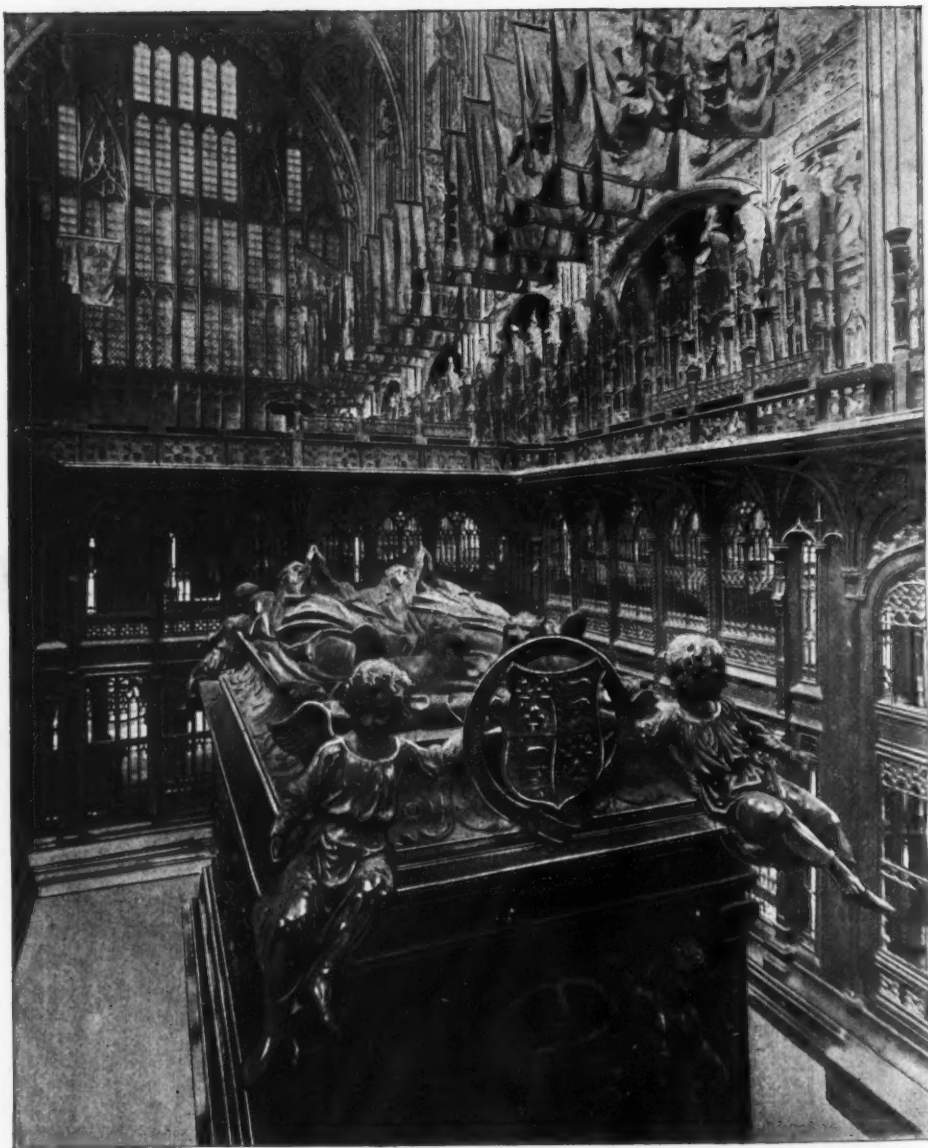
The period of the Restoration was one of relaxed efforts, the high earnestness, the overstrained force of the previous generation was followed by the natural reaction of a mockery at all serious effort. Wren alone of the artists of his day was inspired by noble ideals, but he woke no echoes in the sculptors of his time—the Pediment of St. Paul's contains merely a rococo bas-relief of the conversion of



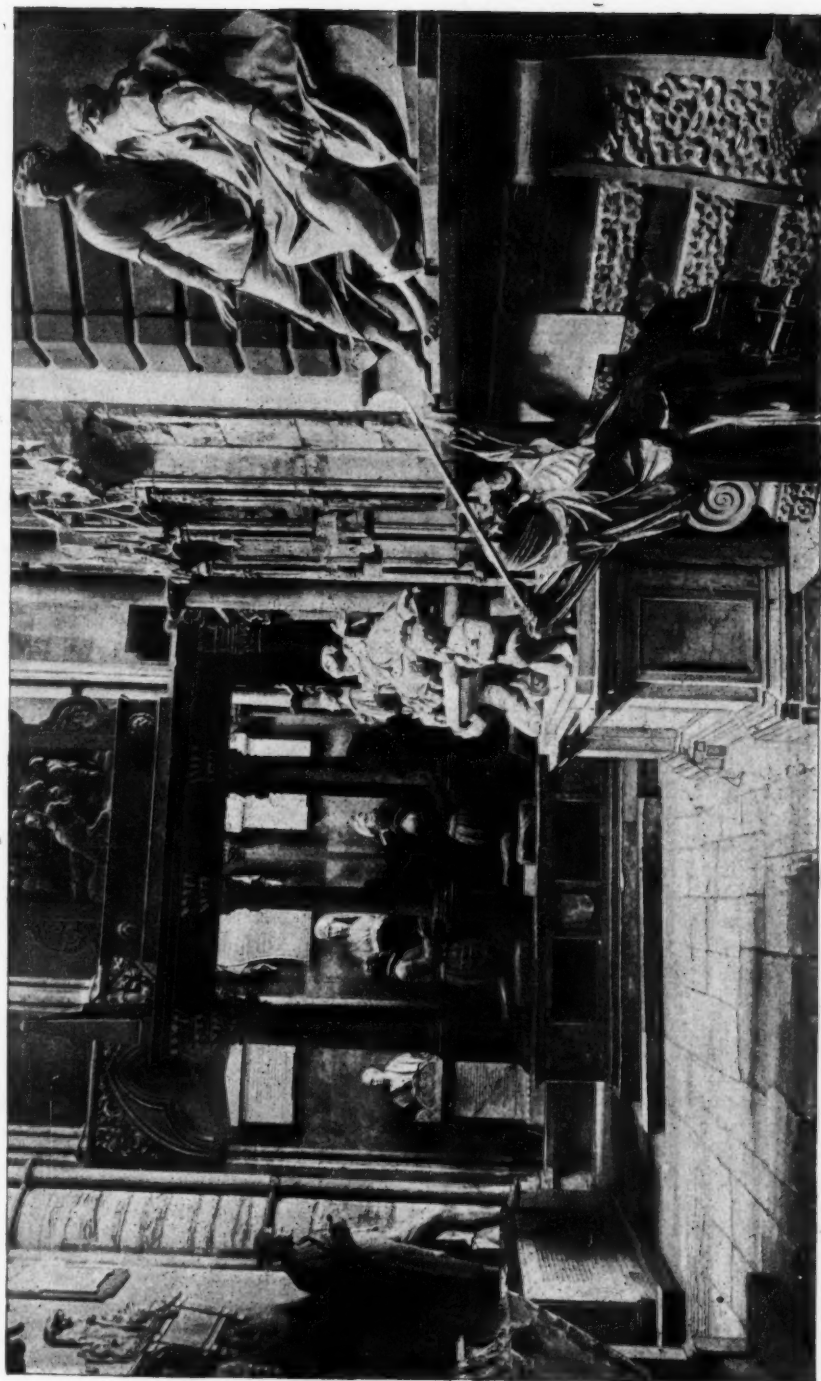
CHAPEL OF QUEEN MARY, WESTMINSTER ABBEY.



TOMB OF QUEEN ELIZABETH, WESTMINSTER ABBEY.



HENRY VII. CHAPEL, WESTMINSTER ABBEY.



CHAPEL OF ST. JOHN, WESTMINSTER ABBEY.

St. Paul, possessing only a certain picturesqueness, in common with the group which accompany it on either side. The most notable effort of Gibson, the sculptor of the period, was the statue of James II., at Whitehall, where the King figures as a laurel-crowned Roman general, toga and armor and all to match, a work in bronze on a stone pedestal.

The efforts of sculptors were then principally turned to monuments, hundreds of which are plastered over the walls of our old cathedrals, Westminster Abbey receiving a large share, the most popular being the nightingale monument of Roubillac, who, though born at Lyons, executed all his work in England, where he died in 1762. We must be forgiven if we hurry on from this period to that of Flaxman, in whom pure outline found perhaps its finest exponent; his illustrations to Homer are too well known to need more than a reference. His physical weakness prevented his executing personally his own sculpture and led him to invent the pointing machine by which sculptors have been enabled to abandon the chisel, to rely on modeling alone, which is, architecturally considered, a falling off from the practice of Michael Angelo and the old sculptors.

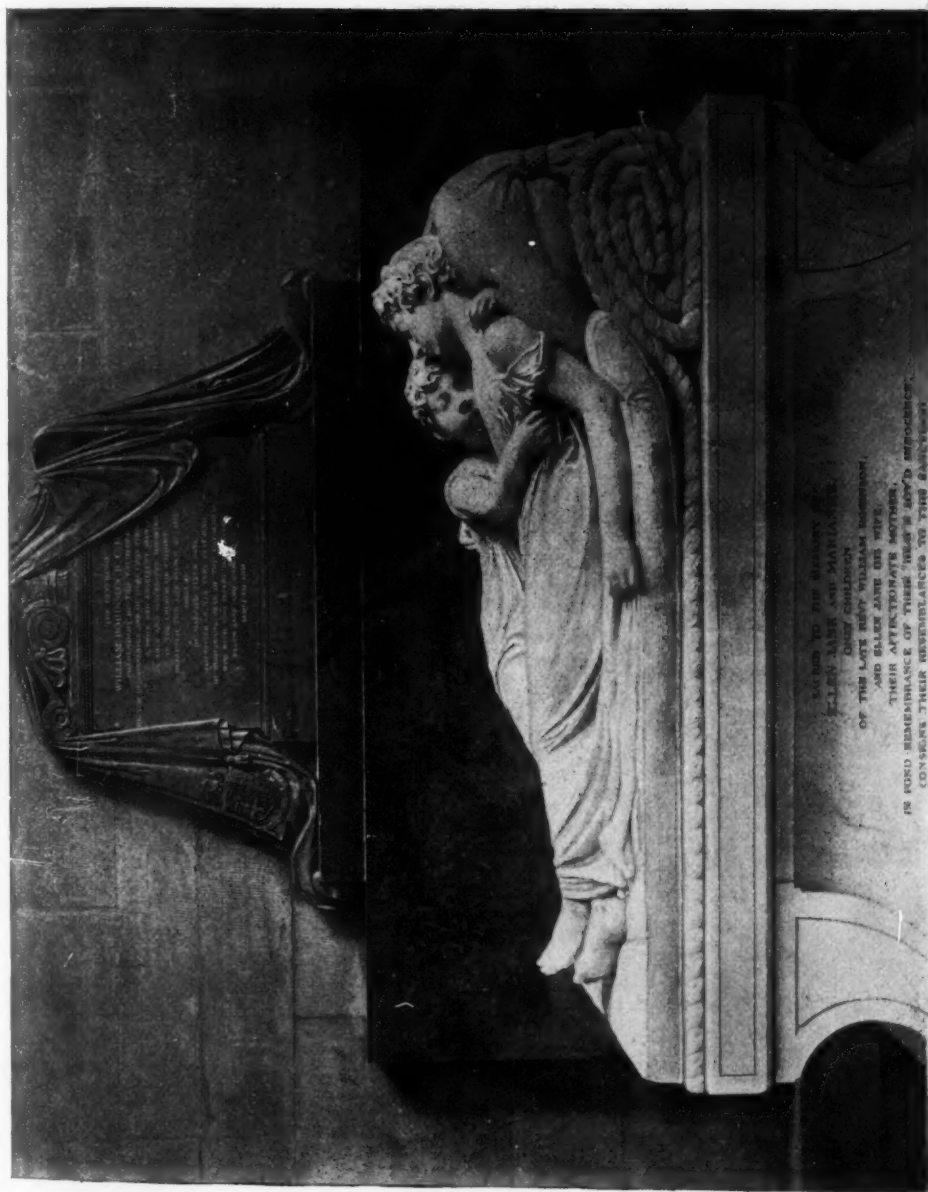
Chantry is better known as an artist than Flaxman, which is perhaps due in part to the literary skill of his assistant, Allan Cunningham, and to the large fortune which he amassed by his art and left to the Royal Academy for the annual purchase of works of art, both causes contributing to preserve his fame. Of his work, the *Sleeping Children*, in Lichfield Cathedral, is perhaps the best known and most popular example. The children are portraits, which is held to excuse their want of beauty of feature. Another well-known work of Chantrey's is the monument of Judge Mansfield, in the Abbey, which would be better appreciated if it were placed in St. Paul's. Gibson was perhaps a greater art-

ist, if the closeness of imitation of Greek work be the test. There is a group of his in the Houses of Parliament, which illustrates the position of sculpture in relation to architecture at this period. Everyone whose artistic instinct is even moderately developed recognizes at once upon seeing the work that nothing could be more inharmonious. The Greek character of the work is destructive by its scale and feeling of the Gothic background, and the whole room seems crowded by the importance given to the statuary.

The Gothic Revival in fact had no counterpart in sculpture; there was perhaps too little to go upon, hence sculpture fell into the hands of a new race of inferior carvers, who produced regiments of saints and kings, at so much a head, generally doll-like in size and vacuous in expression. We should perhaps except Thomas, the sculptor of the Houses of Parliament, whose figures on the façades of that building accord



The original plaster model of Marius in South Kensington Museum, by Bailey, R. A.



THE SLEEPING CHILDREN, LICHFIELD CATHEDRAL. BY CHANTRY.



QUEEN VICTORIA (BY GIBSON), IN HOUSES OF PARLIAMENT, LONDON.

with the style, though perhaps not in themselves of very great value. Thomas was one of the masons employed for the building of Birmingham grammar school, of which Sir Chas. Barry was the architect, and by whom he was brought to London, where he worked for the Westminster Palace; afterwards he attempted architecture and sculpture of his own, the fountains in Kensington Palace being perhaps his best work.

of study in your art schools, but to us the head of Marius is a painful reminder of the long stumping by which we reproduced Menelaus' ugly countenance, and Eve seems to have been a sister of Venus, which accounts, perhaps, for her fall.

We feel unequal to a serious treatment of this art; we offer our pen to the critics to fill in at their pleasure. There was of course some good work



Eve Listening. South Kensington Museum, by Bailey, R. A.

If sculptors then had not much share in the Gothic Revival, they found in the great Exhibition of 1851—that turning point in English art—an opportunity of displaying the unaided resources of sculpture. We regret not to be able to show other examples of this period, but the work of Mr. Bailey, R. A., which we give above, will enable our readers to judge of the Venuses, Eves, Adams, and Apollos, that now decorate—fortunately only in plaster—the Crystal Palace at Sydenham, and are a legacy from the great Exhibition.

We have no knowledge of the course

produced, but we may safely say it was on the wrong path. Architects have repented and turned from their evil ways and so have painters, but the movement of sculptors is slower and the traces of a reformation are not so clear as we could wish.

Amongst a domestic people, living mainly in small houses, there is small scope for semi-Grecian statuary. It savours of affectation to adorn the home with the conventional product of the studios, borrowed from the art of a people whose habits of life were the reverse of our own. Even in our

large country houses, the want of harmony between such work and the usual architecture is clearly felt; for instance, look at the classic statuary in the corridors of Eaton Hall, Cheshire, or any other modern Gothic hall, while the device of a sculpture gallery annexed has the savor of the pedantry of a private museum.

In our conclusion we shall dwell on what seems to be the remedy, namely, a reduction of scale, a change of detail and feeling and a greater practicality of aim.

The Venus we want, if we must have one, is the "Venus of Botticelli," not "of Canova," and the difference is the measure of that influence of the early Renaissance we wish to see in our sculptor's work.

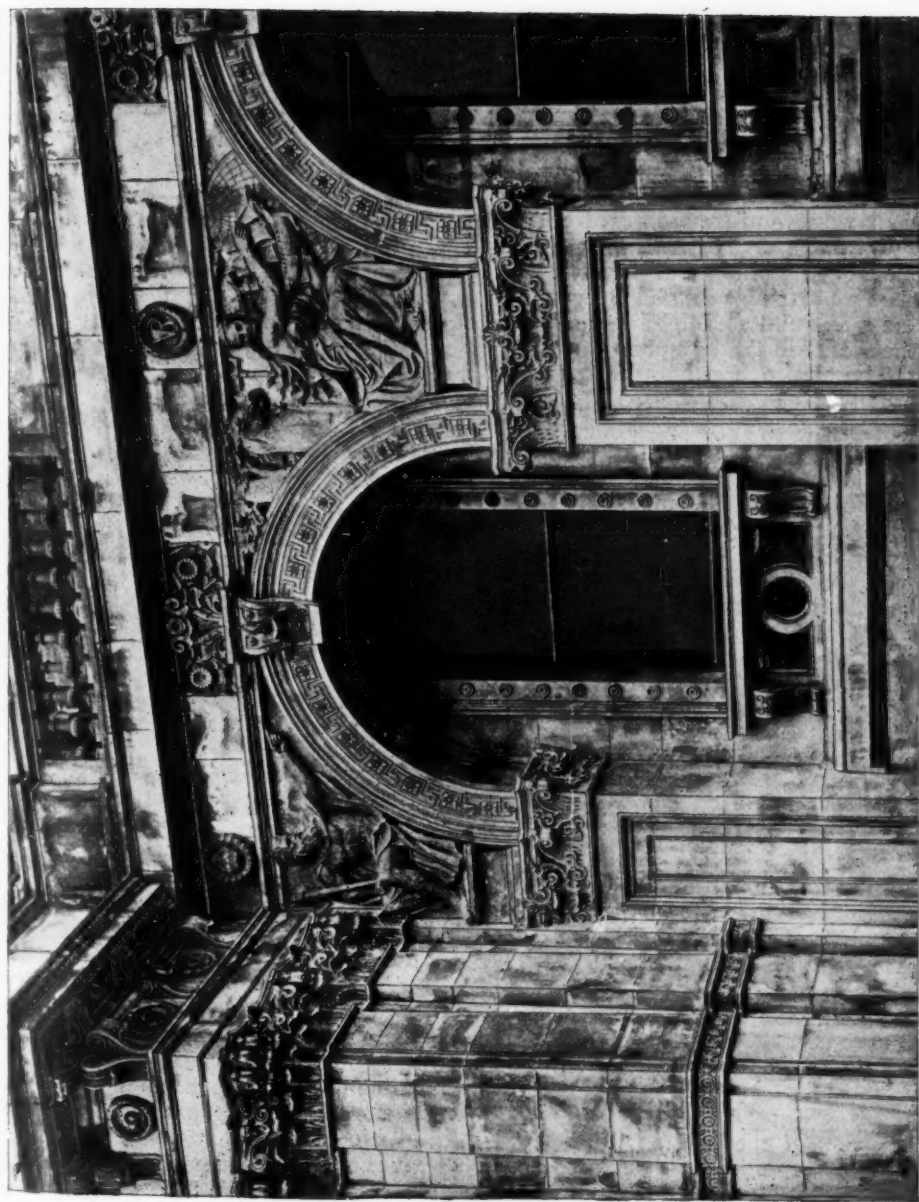
The problem of the reconciliation of the ideal products of the studio, with the conventions and limitations of our houses, and home life, is for the sculptor to solve. What for our daily life have they to offer us? Nothing of beauty is superfluous in this dull monotony of ugliness, which we confess to form three parts of this London of ours. Surely in vain we cover ourselves in the sweepings of the old world, but the most successful hunter of curios has least adorned his house. The dry-bones of dead art are in place only when in the museums or the studios. Sculpture co-operating with architecture can fill the void and, working of itself, can on the lines of the true Renaissance also solve the other parts of the problem.

Let us drive out the inane French bronzes that occupy our mantel shelves and let our sculptors give us instead ideal work, two feet instead of six feet high, as Sir Frederic Leighton has lately done with the "Sluggard" and the "Python Slayer." We welcome this step in the right direction, and we regard the movement amongst architects in favor of the early Renaissance still more favorably, for the profuse detail of that style is the joint product of architect and sculptor, as in the façades of the Certosa at Pavia, and countless other examples of the same period. In wood and metal, in plaster and marble, in furniture and fittings lies the field for

good work, demanding the highest skill in the use of the figure, if the characteristics of the best period of the early Renaissance are to be preserved.

That the degraded state of sculpture in England in the past has been due to the absence of feeling for detail and accessories is very evident, and has lately been curiously emphasized by the work of Mr. Alfred Gilbert, A. R. A., whose monument to Professor Fawcett in Westminster Abbey contains as much thought and skill in a few square feet as would once have sufficed to block up the whole wall of a cathedral with an unmeaning mass of allegory. Allegory has been a grand snare to former sculptors, a veritable "Triumph of Allegory" has defaced our cathedrals with monuments in which our heroes play the smallest of minor parts along with Neptune, Britannia and the other members of the Allegory Company. A violent reaction against such work has endowed us with the still more monstrous "portrait" statue, the adornment of the Thames Embankment, where the heroes of this generation, in brazen boots and cheap tailoring, address to invisible crowds the same boring speeches which they uttered when alive. In the midst of such a wilderness of misapplied art the statue of the Queen at Winchester, by Mr. Alfred Gilbert, A. R. A., displays the true application of the early Renaissance; the elaborate architectural treatment of the Throne with its niches and figures is contrasted with the simple handling of the flowing robes. In this excellent work we may see how the life-like portrait of the Queen is enhanced by such masterly characterization; while a glance at the back of the Throne demonstrates that no labor has been spared to give that sense of repose which is induced by completeness of detail and design.

No work of art can be complete without the greatest possible amount of thought being bestowed on it, and this is one of the many great qualities with which all Mr. Gilbert's work seems to be imbued. This application of thought takes time and requires patience on the



HOME OFFICE, LONDON. SCULPTURE IN SPANDRILS BY ARMSTRONG.

part of the public; but what matters it if the public do have to wait a year or two longer for the Shaftesbury memorial at Piccadilly Circus; if, when it does come, it is a "thing of beauty and a joy forever."

The skill of using the past in the work of the day is one of the greatest needs of the present age. We want on the part of our artists a personal force, that fuses the elements we have to deal with, and re-creates from them the work of art in its completeness and harmony. This power is what raised such an artist as Alfred Stevens from the ranks and enabled him to produce the work we shall allude to later on.

The co-operation of architect and sculptor is another most urgent need of our art to-day, and we now propose to glance to some recent instances more especially to illustrate the influence of early renaissance ideas on them both. In our mention of the Gothic Revival we have alluded to the small share that sculptors had in it, not but that much talk was then as now common on the subject among its professors, resulting, however, in little besides the Albert Memorial in Hyde Park.

In Sir Gilbert Scott's notes on his own life he praises warmly the work of Mr. H. H. Armstead, R. A., the sculptor of much of the great bas-relief frieze which forms the leading feature of the design.

We may take this to show that, so far as they were concerned, harmony reigned, and the architect found adequate support in carrying out his design. Of the groups at the angles, it is impossible to speak so favorably; undoubtedly the best is Asia, by Foley, R. A., which we give above, and had he lived to complete the central statue, the result would have been other than it is. Americans may complain, with justice, of the sensational vulgarity that characterizes the group representing their continent. Mr. Arm-

strong's ability is also shown in the Home Office, Whitehall, where his vigorous spandrels give value to a not particularly significant arcade—his work, in fact, is characterized rather by vigor than grace, a fault, however, the reverse of the usual failing of the English school. The two figures of Moses and St. Peter in the restored reredos of the Abbey are also by him, and show perhaps more clearly than the Albert memorial, that his work has not too much Gothic feeling; the latter is, in fact, so Italian in character that the sculpture of that day accords sufficiently well with it, while it may serve to show that any employment of sculp-



Asia. By Foley, R. A. From the Albert Memorial.

ture and architecture together, on a large scale, really involves a strong Renaissance bias.

It is a pity that the opportunity afforded by the Law Courts for testing this point was not availed of by Mr. Street, but it must be ascribed to the parsimony of the government that the sculpture of that great building is so slight, consisting only of a few gable statues. Inside, however, in the great Gothic vaulted hall, Mr. Armstead has executed a cenotaph to Mr. Street, its architect, and how far it accords with the surroundings may be seen in the illustration. We shall close our notice of this sculptor's work by an illustration of a recumbent figure for a tomb which has another in-

terest in that this is the style of monument, mostly in favor, in our day, for such memorials; the undoubted gain in reverence over the memorials of the preceding age will not be disputed, though it is surely by no means the last word of sculpture for Christian tombs.

Among important modern buildings, the Glasgow Town Hall errs perhaps by the novel fault of using too much sculpture, if such be possible, at least it has been said that the interest of the building is on that side. Other recent works have not certainly that failing; the Birmingham Law Courts façade has in the gables some good modeling in terra-cotta, which, indeed, seems the very material for the modern sculptor, as his own work can be rendered durable, without the translation into stone or marble by another man. It is to be hoped that the same architect will give us in the new buildings of the South Kensington Museum, a good example of its possibilities. One of the competitors for that building, Mr. John Belcher, showed a band of most graceful figures along the front, apparently designed by a sculptor, in fact a group representing Science, by Mr. Thornycroft, R. A., adorning the new building for the Institute of Accountants, in London, has been illustrated in this journal, Mr. Belcher being the architect. Another work, illustrated in *THE ARCHITECTURAL RECORD*, was Mr. Pegram's Sibylla Fatidica, and our readers will turn to it with interest when they realize that he is engaged on the sculpture of the Imperial Institute. This last named Early Renaissance and very modern building is now very familiar to art students and is approaching completion. Mr. Pegram's work is principally in the main porch, a large figure of Navigation represented by a female figure seated on a Bench corresponds on the return jamb of one side to a similar figure representing Manufacture on the other.

It is too early yet to judge of the results of this instance of co-operation between sculptor and architect.

Since the Albert Memorial, the reredos of St. Paul's Cathedral has been perhaps the finest chance for com-

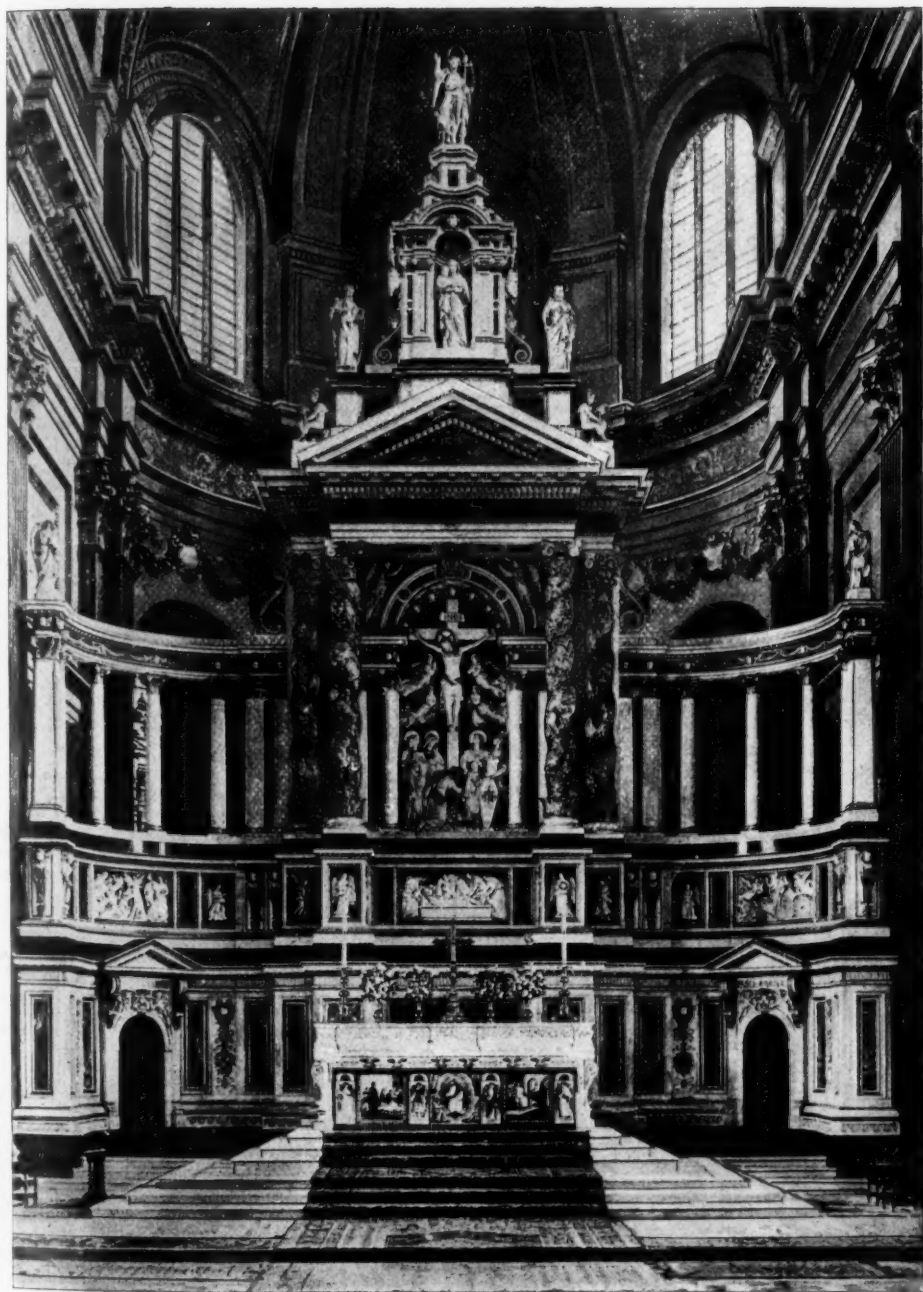
bined work. In this instance we seem to feel the want of greater freedom and scale on the side of the sculptor. We believe we shall carry with us all lovers of Italian art when we assert that however great the defects of Italian and Spanish reredos they, at any rate, are right in the tendency to predominance on the part of the sculptor's art. Imagine, for instance, such a sculptor as Alfred Stevens sharing in this work at St. Paul's, and we shall see at once how inadequate is the mere carving of the present reredos in comparison with the figure work that would have taken its place. We say this, not wishing to depreciate the merit of the actual work, but rather lamenting the boundaries imposed by the architectural scheme. At any distance the panel work is lost, in spite of the questionable device of colored backgrounds, which, in regard to the black painting of the main pilasters, is now about to be removed, with the concurrence of the architects, Messrs. Bodley and Garner.

The reredos of S. Giovanni e Paolo, at Venice, perhaps the finest of late Italian examples, with other and even bolder instances of united architecture and sculpture will readily occur to our readers, and the use of the more refined detail of the cinquecentist need not surely deprive us of the scale of the later work.

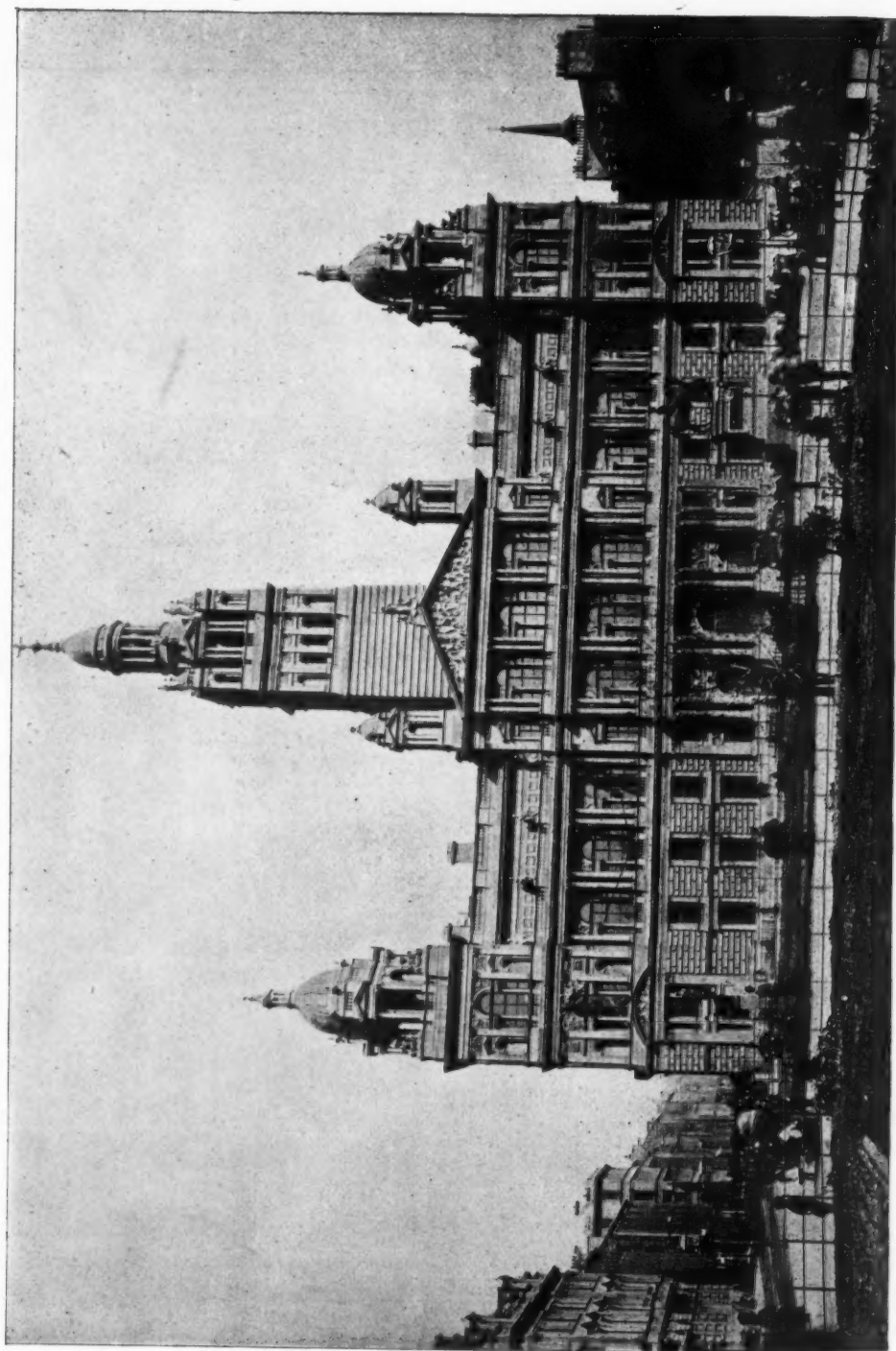
The Wellington Monument, by Alfred Stevens, in St. Paul's (see page 436) illustrates our argument; the miserable mistake of the position of this masterpiece prevents any adequate photograph or view being obtained, the views, however, enable me to show what folly it is to place such a work in a narrow and contracted chapel, instead of below one of the main arcades to the nave, the position for which it was designed. Surely it is not too much to hope that, as the fame of the artist increases with each succeeding generation, the wider appreciation of his masterpiece will cause a successful movement in favor of placing it in the true position, where it will form one of the glories of the Cathedral. It will be seen that the tomb consists of marble and bronze, and belongs to the same class as



THE WELLINGTON MONUMENT, ST. PAUL'S CATHEDRAL, LONDON.

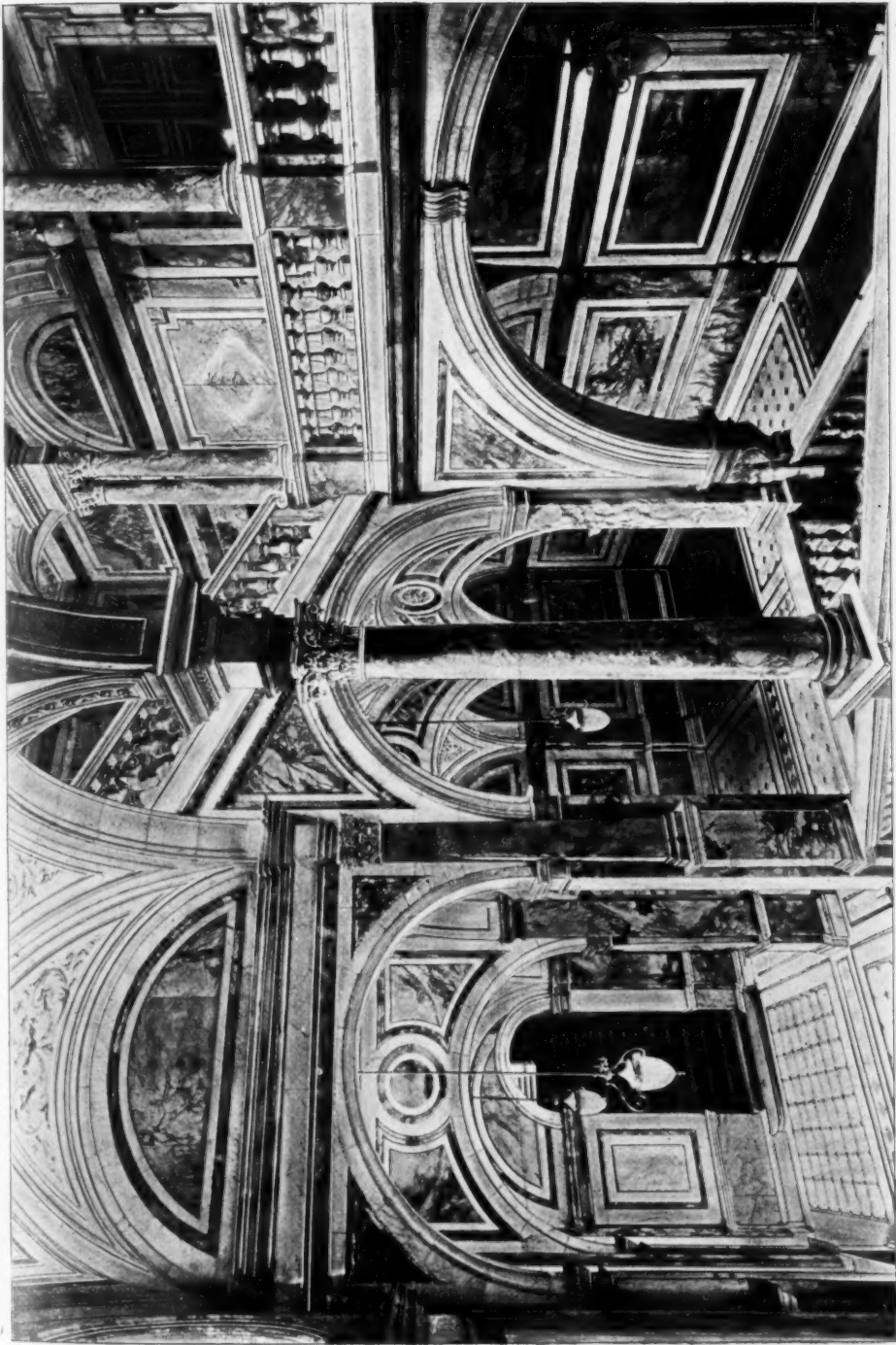


THE REREDOS, ST. PAUL'S CATHEDRAL.



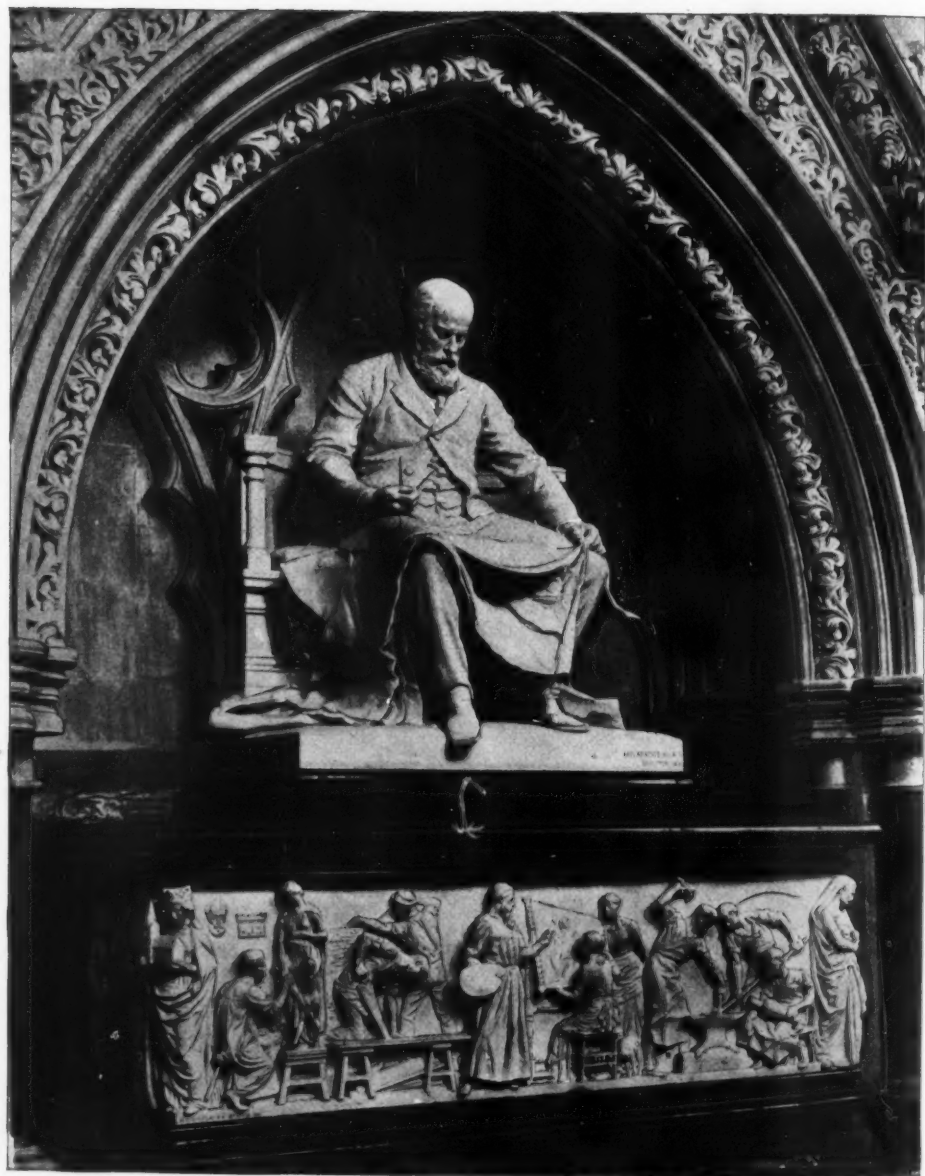
MUNICIPAL BUILDING, GLASGOW.

William Young, Architect.



PRINCIPAL STAIRCASE, MUNICIPAL BUILDING, GLASGOW

William Young, Architect.



CENOTAPH TO STREET, BY ARMSTEAD, IN THE LAW COURTS, LONDON.

the Jacobean tomb described and illustrated before.* Where it differs is in the masterly combination of sculpture of the highest class and on the largest scale with the architecture. This feature lifts the whole work at once far above these monuments, and also above the latest Italian altar pieces, where the sculpture and architecture is of a debased type.

It is also analagous with the grand Italian Tombs of the middle ages and of the Renaissance, as at Verona and Venice, but it is unique in possessing ideal groups as the Valour triumphing over cowardice, shown in our view, and the Truth pulling out the tongue of Lying at the corresponding end, on such a scale and in such a magnificent form. The peaceful calm of the Duke himself on his finely treated bier will also deserve attention, and that general unity and appropriateness of detail, the want of which has so often been alluded to in former work, cannot be too highly praised. The crowning of the monument remains uncast, thanks to a foolish joke by a former Dean to whose ignorance of art, even in England, it appeared a strange thing that a man should be on horseback on the summit of his own Tomb. It is now proposed to cast this crowning statue so that the monument when moved may be seen in all its perfection in its true position beneath the nave arcade. We regret that we are unable to illustrate other works of this artist, but photographers in England are nearly all concerned only in what the public, understood in the narrowest sense, will buy, but we would refer our readers to two books of Alfred Stevens' work, the first by Mr. Armstrong, entitled, "*Alfred Stevens, a Biographical Study*," and of the later one, a splendid folio produced by the autotype process under the auspices of Mr. Hugh Stannus, it must suffice to say that nothing was too common for his art to touch, whether metal stoves, tile floors or china dishes, *all* were made to bear the stamp of his personality. Like an artist of the

great period in Italy, all things he touched he adorned in a style in harmony with itself. His influence may be traced in the terra cotta and faïence detail employed in the present South Kensington Museum buildings where his pupil, Mr. Moody, was employed, and other buildings have owed much to his example. Little appreciated by the many in his own age, Stevens runs the risk now of that false praise of which imitation is in art, the expression. He is best praised and best followed by students who study as he did. Imitation of his personal manner will be as fatal as that of Michael Angelo was upon his followers and mannerists. Mediocrity is only too ready to shelter itself beneath the great name of a master—growing like the ivy, it obscures for a time the qualities of that which it clings to, and leads the ignorant to deny the tree for the ivy.

The independent system of study pursued by Stevens, living by himself long years in Italy, in itself a training far different to the atmosphere of art schools, raised him above that false pride which has existed too long in the minds of sculptors on the subject of the union of sculpture and architecture.

That a different feeling has of late been manifested by some sculptors, who have protested their desire to work with architects, in the adorning of their buildings, we may fairly ascribe to the influence of the Early Renaissance. The school of Bernini has yielded to that of Donatello, and sculptors like Desiderio and Nuno and others of the great fifteenth century are now honored to an extent that the last generation would have deemed incredible.

The growing wealth and costliness of modern building enterprise render feasible an elaboration of detail of the highest class, that formerly would have been deemed impossible, except in such extreme instances as the Houses of Parliament, in which case, however, the architect had to support many grievous reproaches on this very account.

Moreover, the interiors of such modern buildings, their furniture and fittings, afford equally good fields for sculptural display of far greater art

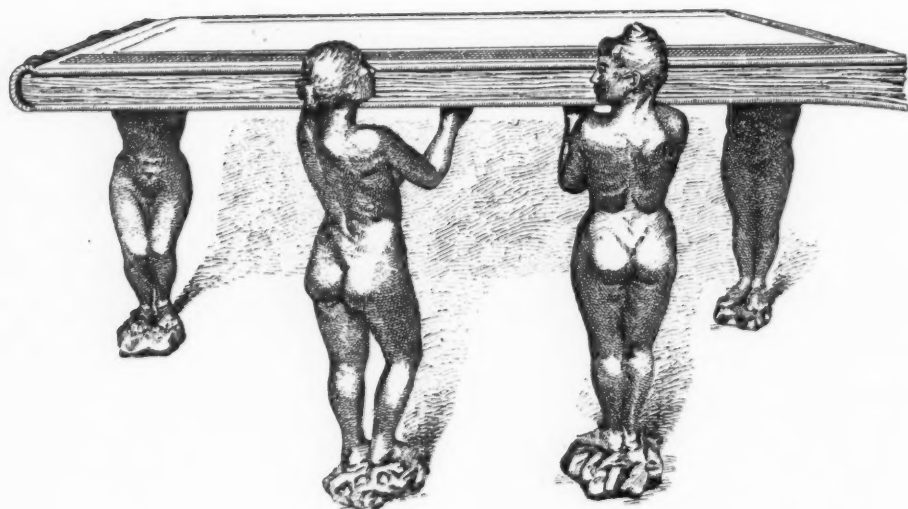
* Even while I write the movement has now happily begun, having been started by a letter of Sir Frederic Leighton to the "*Times*," and is likely to be brought to a successful conclusion.

value than the independent pedestal statuary of the past age when the lessons of Greek work were misunderstood and the union of architecture and sculpture, so perfectly exemplified in the Parthenon remained unimitated, and the path of sculpture was lost.

Nor, as we said above, did the Gothic

revival, that reformation of architecture, equally regenerate our sculpture; let us therefore hope that the grand lessons of the third great period of art, the early Renaissance, will not pass unheeded, but that English architects and sculptors, in union, may press on to scale these heights of art which have yet to be reached by the human race.

Banister Fletcher, Fr. A. R. I. B. A.





New York City.

TOWER OF "MAIL AND EXPRESS" BUILDING.

Carrère & Hastings, Architects.



Chicago, Ill.

WOMAN'S TEMPLE.

Burnham & Root, Architects.



Buffalo, N. Y.

ERIE COUNTY SAVINGS BANK.

George B. Post, Architect.

SOME PRACTICAL LIMITING CONDITIONS IN THE DESIGN OF THE MODERN OFFICE BUILDING.



THIS term, "modern office building," is used to describe the mammoth structure, of many stories, that the conditions of our present business life require us to erect in all centres of population where the fever of money getting is permitted to have full swing, unhampered by any traditions that involve avoidable loss of time.

Whether this building is so high by reason of the desire of men of all callings to come as close to a given centre as possible, to the desire of men of similar callings to be as close together as possible, is due to the superior service that can be rendered for the same outlay, or is due to the necessity to procure enough rentable space to be able to pay interest on the total amount of

money invested, might be discussed at considerable length, but is foreign to the present subject except in so far as it furnishes one of the limitations of the problem.

The elements that must be combined in the successful building are :

- (a) Ease of access.
- (b) Good light.
- (c) Good service.
- (d) Pleasing environment and approaches.
- (e) The maximum of rentable area consistent with true economy.
- (f) Ease of rearrangement to suit tenants.
- (g) Minimum of cost consistent with true economy.

These may also be separated into two classes, those that particularly interest the tenant, which are the first four; and those that interest both tenant and landlord, or the landlord alone, which comprise the balance. At

first sight it might seem as though the two interests were antagonistic, but a little thought will show that if the landlord sacrifices the tenant's interest he will in some ratio affect his own by reducing the value of the space he has to rent; on the other hand he may sacrifice his own interests in a way that will render it difficult to secure a proper return, by unnecessarily wide halls for example, and it is to establish a proper relation between these various elements that the following is offered.

(a) *Ease of access.*—This can be had either with a low or a high building, of which the latter only interests us. With the floors placed one above the other it is necessary that they be reached by elevators, and the solution of the problem depends on them almost entirely. First then, we would state that *the elevators must be placed so as to be reached directly from the street and only a few steps above or below the level of the sidewalk.* This rule holds true no matter what the character of the principal offices. Occasionally it will be noticed that some large financial institution erects a building for itself with about two-thirds of its space rented in offices, and for effect a very fine entrance will be made with imposing steps up to a platform several feet above the street, requiring every person entering the building to climb up before beginning the trip in the elevator. Second, we would state that *all of the elevators should be grouped together* unless the building is very long, is located so as to front on two streets of equal importance and is very high, and as a corollary of this, all of the elevators should be so placed as to be readily seen by a person standing in the middle of the space devoted to them, so that when he wants a car he can take the first. Instances of the violation of this rule and the annoyances thus arising are no doubt fresh in the reader's mind. The rule is correct even where it would seem to be desirable to have a double set on the supposition that at least half of the tenants would use one set while the general public would use the other, for the public who come to see the tenants are the ones who are to be most consulted really. To put this in another

way, the time-saving device that requires a guide book to call attention to it is of but little value and its cost had better be saved or placed elsewhere.

Further on the arrangement of the offices and court is discussed, and it is there shown that the elevators should be so placed as to bring them about equidistant from the extreme offices; this is so, even when it makes a little walk for every one entering the building. Of course it would save for the average travel of the person entering the building to have the elevators near the front, but it would involve the sacrifice of very valuable room, and if a tenant wanted an unusually large area, it would make it very hard to accommodate him. Third, we have the cars, their speed, size, capacity, etc.

To determine these points practically, observations were made for the writer by one of his assistants of twenty of the better class of office buildings in the lower part of New York City, taking notes as to the number of stories served, number of elevators, number of offices, interval between trips, working speed, size of car and number of passengers, and an attempt was made to reduce the results to some uniform law. It will be seen at once that this is very difficult, as the service in each building depends upon the class of tenants. What would be good for one kind would be intolerably slow for another, and in the application of the following rules this condition must be remembered.

From the notes it was found that those buildings that gave the impression of a good service, had a car-interval ranging from thirty to forty seconds, so that the condition of good service would be that the interval between the trips should be such that in no case would it be necessary for a person to wait for a car longer than forty seconds. The next point was that the speed for this service was about 400 feet per minute, which would be 6.67 feet per second, or 1.87 seconds for the time required to travel from floor to floor, on the assumption that each story will average 12 feet 6 inches between floors. Now, independent observation has

shown that an elevator car travels from one-third to one-eighth of the time, the time spent in traveling increasing with the number of stories served and decreasing with the increase in the number of offices on a floor, so that while two elevators could easily accommodate 150 offices, if they were placed in eight stories, they could not do so if there were but two stories, unless the size of the cars was very much increased. The time that the elevators are not running will thus be seen to fix the number, as well as the size and the speed. If we assume that they run one-third of the time, we would have for the time for the round trip of a four-story building, forty-five seconds. Practically the interval is a little less where the travel is more than four stories, sufficient to make it forty seconds as an average.

As an instance of the influence the number of offices on a floor and the number of stories have on the number of elevators needed in a building, we may note the case of one building of seven stories and 240 offices that has its tenants easily accommodated by two cars, while a building of twelve stories and 271 offices has four cars fully taxed all of the time, the character of the use being similar. As near as could be determined a car 5x5 feet gives good satisfaction, and such a car, at a speed of 450 feet per minute, will serve seventy-five offices well if they are placed on more than two and less than six stories, and if the service is such as to give more than this number of offices to a car or a greater travel, the number of cars should be increased. Finally, it may be said that for a 25x100 feet building two cars are needed for all services between four and fifteen stories, and for a 50x100 feet building there should be two cars up to eight stories, three up to thirteen, and four up to twenty, and it is probable that four cars will provide for any additional number of stories that it is practicable to build on this width.

For a 100x100 feet building, we should have four cars up to ten stories, five up to fourteen and six for all above that number.

It has already been said that the cars

should be about 5x5 feet; this is for ordinary service. For a building in which there are more than twenty offices on a floor there should be added one square foot of area to the car for each additional office until the car reaches a size of 6x6 feet, beyond which it is not well to go, and then the number of cars should be increased.

Other details of the elevators should be in part determined by the character of the building, the space at hand and the like, but in general they should be made so as to lift 2,500 lbs. live load at the full speed, should have the entire front readily removable, and should have the governing device in the corner away from the door, so that when the front is removed the rope or wheel is out of the way. The controlling device should be a wheel, lever or switch, the switch being much better, as it gives more perfect command over the motion of the car. The guides generally should be placed in the corners of the well. This economizes space, although it is not quite so good for the construction of the car. Where there is a reasonable doubt as to the actual number of cars required, it would be well to make ample provision for the probable maximum, and then only install the minimum number that it is thought will do for the service, putting in others later on if necessary. Stairs are not mentioned in this connection as they are never used save in an emergency.

(b) *Good Light*.—This is of the utmost importance and as is usual in such cases there is a radical disagreement at the very start as to the requirements. Some hold that only a north light is truly good while others aver that no building is well planned that is not so arranged that there is a little sun in each office during a part of the day, except perhaps in the lower stories. Now the writer is one of the latter, and, if it were essential that the point should be settled, would be ready to discuss it to any length and could perhaps convince a goodly number of those who were inclined to think so in the first place, but certainly would not convince many others.

Fortunately for our present purpose it is not of the slightest importance which

way the light comes from since while we shall speak of its coming into the rooms, and thus make a certain arrangement preferable, if the plan were reversed, it would still be desirable to keep the axis in the same direction so as to get more of the north light.

The first point then is to get the proper direction for the axes of both the building and the courts. In New York we generally have this already determined by the subdivision of the city into rectangular lots with the long lines making an angle of about $21\frac{1}{2}$ degrees east of the meridian, but elsewhere and especially where it is possible to make a selection, it should be on a bearing of north $22\frac{1}{2}$ degrees east, which agrees quite closely with the New York layout. This will be evident from an inspection of the figure, in which for purposes of ready comprehension the sun is supposed to rise at



the point VI. representing six A. M. and to set at the opposite end of the diameter, then the usual hours of business will be as designated by the numbers IX. and V. and the line which bisects the space between them represents the axial line that divides the hours of sunlight equally, and it is this line that should be used for the axes of the building and of the courts. It will further be evident that if the courts be made square or nearly so they will be so proportioned as to throw the shadow of the south wall on the north wall at the highest point that it can reach and only the top of the court will ever get direct light, while if the court be made rectangular and with the long axis north and south, the light at noon day will penetrate to the very bottom during at least a part of the year, and will go the maximum distance at all times. If the court is open to the south every office that gives on it will get a glimpse of the sun every day that it is visible at all. The courts should be generally from 6 to 25 feet wide depending on the width of the lot and the size of the offices.

From this it would follow that the ideal location would be either on the

northeast or the southwest corner of the street, according to preference for either north or south light, the elevators, stairs, etc., remaining in the same place and the plan being simply turned over. Refer to the figures 1-7 given in the discussion of the point (e) for suggestions as to court arrangements.*

The light must be let into the offices through windows, no matter where it comes from, and these must be made ample. Requirement (f) makes it desirable to use a unit for an office of about 9×15 feet, and to properly light this unit requires a window at least 4 feet wide and 6 feet high with the top not more than 1 foot below the ceiling. The particular point to watch is that where there are large arched openings the offices that come partly behind them shall have plenty of light, either by openings at the sides or by piercing the spandril walls, or in some other way, as the volume of light from the top of the window is of much greater lighting value than that coming in at the floor. Under no circumstances should that part of a window that is below a point 20 inches above the floor count as a useful part of the opening. This is a particularly hard condition to satisfy, it is admitted, but it is one that is unavoidable and must therefore be met in some way.

The light in a room is also made much more effective if there is a certain amount of clear wall space on each side of the window, broken, in fact, only by the furniture. The ceiling should be hard finished, as this reflects much light down to the desks. For the same reason the aim should be to have all of the rooms rectangular and without breaks, alcoves or other similar construction, as they all take from the light and interfere with the tenant's use of the office in his way.

(c) *Good service.*—Apart from the use of the building after hours, janitor

* It is the opinion of some of those who have made a study of the renting of office buildings that the future competition will be made on the question of light and air and that unless the adjoining property-owners agree to keep to the same court lines, so as to make all courts a minimum of 12 feet wide, it would be better to sacrifice the offices on one side of the hallway, so as to insure an excellent light regardless of what the neighbors may do. The writer inclines to the opposite view, believing that the reasons leading one owner to a certain course will be strong to control the others.

service, the necessity of securing elevator boys of some little intelligence and other similar matters that are entirely within the control of the owner, there are the toilet arrangements, heating, lighting and ventilating, to be considered.*

If the toilets should be placed on every floor for the accommodation of the tenants on that floor each toilet should have one water-closet for every five offices, one wash-basin supplied with hot and cold water for each two water-closets, but never less than one, and one urinal for each two closets. In addition, there should be either a small cesspool in the floor with a trap, bell trap and strainer and draw cocks placed on the supplies for the use of the "scrubs," or there should be a regular slop sink placed in a compartment similar to the water-closet compartment, supplied with both hot and cold water and with a strainer placed in the waste. If these fixtures are all grouped on a floor their number may be reduced one-half, but in all buildings 50 x 100 or more, there must be a wash-basin and urinal on each floor. In the floor where the toilets for women are there should be placed a double number of water-closets, and, if possible, sufficient room for a sofa and a connection for a small gas stove; this room should connect through a lobby with the janitor's rooms. The fixtures should all drain into a main drainage system of wrought iron, screw-jointed pipe with shouldered fittings, such as are put in by all of the good plumbers in the city, the pipe being hung preferably to the beams at the middle story so as to minimize the effect of expansion and contraction. This will add about 5 per cent to the cost of the work, but is

the only way the plumbing can be made safe in a large, high building. Each office must be provided with a wash-basin, which may have either cold water alone or both hot and cold, as may be deemed best for the particular case, although it will not be advisable generally to supply more than cold. Connected with this question is the kindred one of whether to filter the water supplied or not. If all of the water has to be pumped to a house tank, it will probably pay to provide for the introduction of a certain small amount of alum as a coagulant into the receiving tank and then pass the water for the house lines through a felt filter arranged so as to be washed down by the operation of a simple lever that works all of the necessary valves. This will add but a small amount to the cost of the plant in the beginning, and is an attraction to tenants. If there is anywhere in the vicinity a refrigerating plant, it would probably pay to make an arrangement to have a certain small amount of brine circulated through a tank, in which would be placed a coil of pipe from which the water would be drawn as needed, giving cooled water during the summer. If the building were very large, it would probably pay to put in a small plant, operated by an electric motor. If the remainder of the plumbing is up to the requirements of the New York Health Department, it will be perfectly safe and needs no further comment.

Heating and ventilation should go together and form a serious problem since cost and methods of construction will not permit of a complete indirect heating plant, and it is also probably the case that it would not be satisfactory to the tenants, while the cost of operation would be very great. Fireplaces are not permissible since they will in almost every case prove to be an unmitigated nuisance, always coming in the wrong place, taking valuable room just where it is most needed and forming a serious item of cost when properly treated. They serve, however, to take some of the foul air from the offices and so do a little good to justify their existence. Probably the removal of the foul air can be suffic-

* Here again there is a division of opinion, one side, and it the practical, office-renting one, holding that the top floor should be devoted, except perhaps a small part, to the living rooms of the janitor, the men's and women's toilets, while the other, the architects, usually advising that the toilets be placed on each floor and the janitor given quarters elsewhere. The writer has figured on both ways and finds but little difference in the space lost. If the toilets are grouped at one place only one-half the number of fixtures are required; but the space so saved must be given to the janitor. Then there must be provided a basin and two or three urinals on each floor. Figures 1 to 7 show the floors without toilets, and the estimates of cost in the tables are based on there being toilets on each floor with the accommodations determined upon in this article.

iently well accomplished by putting in transoms over the hall doors and opening the halls to the outer air at some convenient point where there will be no back draft into the halls. If it is preferred, moderate size ventilating pipes could be run to each of the offices, being collected into a main stack running vertically through the building and the circulation assisted by means of a small fan run occasionally, simply to start the circulation. Exhaust fans have a way of taking their air along the lines of least resistance and that makes it undesirable to depend on them entirely.

To introduce the needed air and to warm it to the proper temperature it is desirable to use a direct radiator with a box base, connected with the outer air by means of a small galvanized iron pipe with a damper in it, so arranged as to open the base to the air in the room as it closes it to the outer air. Then in the morning when it is desired to warm up quickly the damper would be closed to the outer air and the air in the room would be warmed by the circulation which this radiator would set up. As soon as the air was of the proper temperature it would be maintained at this point by the opening of the damper so as to admit the fresh outer air, warming it as it enters. Such an arrangement is no novelty and has been found to be generally satisfactory.

It goes without saying that, whether there is a public supply available or not, the building will be lighted primarily by electricity. If the public supply is not satisfactory either in cost or quality, then a gas engine plant should be installed, taking gas from the municipal supply, burning it in a gas engine, and getting more light from it than could be done if the gas were burned in burners directly for illumination. There would be placed a single gas jet in each room for the scrub's use or for an emergency, but the lighting would be by electricity. Each room should have at least five outlets, one in the centre for the chandelier, with all of its lights controlled by a switch at the side of the entrance door, and four placed near the four corners of the room. It is the practice with

certain architects to make these lights, that are for desk lights, brackets, but it is inevitable that they will prove to be in the way of at least 75 per cent of the tenants, besides which they interfere with condition (*f*). These outlets should be simply the junction box of the Interior Conduit and Insulation Company, with the rim flush with the plastering, and covered with a brass cover carrying a hard rubber bushing and small male screw. Inside of the box would be placed the fuses on a hard rubber base and the binding posts for the connection of the fixture wires. From the outlets so arranged would be carried the twin wires for the light, terminating either in a socket carrying a shade or in a more elaborate fixture or in a desk fixture, the wires being drawn over to the picture moulding and then down to the desk. If the wiring is done according to the rule of the New York Board of Underwriters, it will be of sufficient size to supply ample light. The central fixture should have four lights for each office unit and might have a Greenfield switch in it for use in the office, so as to make the reach to the fixture easy for short people.

Should lights be desired at any point intermediate between the ceiling outlets, a small brass tube could be arranged between the outlets and carried by them, on which the pendant could be traversed by hanging it to a ring.

(*d*) *Pleasing environment and good approaches* are both matters within the control of the owner, subject to the treatment of the artist, and are not pertinent to this article.

(*e*) *The maximum of rentable area consistent with true economy.*—This must be considered in two parts; first, as to the plan, and second, as to the way in which it shall be carried into execution.

First: *The Plan.*—There must be on each floor the elevator-well, the halls, the stairs and the toilets; each of these require a certain amount of space, and for economy of construction it is desirable that the various floors be made duplicates as far as possible, while for some of the features it is a necessity.

Having decided on the size of the elevator car according to principles already laid down, the well should be

made one foot larger in each dimension than the size of the car. It should be placed at or near the centre of the building, and, of course, must run all through plumb and true.

The halls depend on the size of the building to a certain extent, but for the usual case of the 25x100 or 50x100 feet building they must be made as small as possible. Then we would make the hall on the ground floor as direct as possible from the street to the elevators, and 8 feet wide, with a space in front of the elevators of the size of the well. For the upper floors, if the space be made 4 feet wide in front of the cars and the halls 3 feet 10 inches wide, it will be ample if the trim is not too projecting, the space in front of the cars being joined to the side halls either by a sweep or straight.

For the stairs it should be kept in mind that they are for use only occasionally, and are in no sense ornamental features that are indispensable, except occasionally when they are meant to lead up to grand offices on the first floor above the street. Generally the money that they cost could be spent to better advantage in the enrichment of the entrance hall. Leaving the question open as far as the special cases go it may be said that if through the balance of the building they are made 2 feet 6 inches wide that will be sufficient for all practical purposes. They should be placed at the end of the hall or at some other out-of-the-way place and be made as plain as possible.*

The toilets require for their accommodation space as follows: For each water-closet a space 2 feet 6 inches wide and 3 feet 10 inches deep, for each urinal 2 feet wide and 3 feet deep and for each wash-basin 2 feet 6 inches wide and 3 feet 6 inches deep, all as a minimum.

The toilets must be placed where they will either come on a light well or else be placed on an exterior wall and

would, therefore, be placed in a corner or angle.

It will be found that there are often tenants that desire an entire floor, and to secure this the service should be placed where it will not interfere with the removal of all of the partitions.

The size of the offices must be so arranged that the man who wants a single office will get just sufficient while the man who wants more gets all that there can be given on a floor except a minimum space reserved in the least desirable location for the toilets and stairs. This subdivision forces one into a column treatment of the façade, so as to get sufficient light for all of the offices, and also indicates a spacing of the columns in the framing that is the most economical as a general rule.

Such an arrangement gives opportunity to make the masonry piers of sufficient width to satisfy the sense of proportion regardless of their height and introduces no greater difficulties into the solution of the problem than were there before, nor will the design of different office buildings possess any greater similarity if so laid out than they do now. In fact it would be well if the principles were so well understood that the owner could protect himself and the public from the *novel*, etc., solutions that one sees occasionally.

The economical depth of an office must also be taken into account in the planning for, after a certain point is reached, no more money can be obtained for an office no matter what its depth. While there is but little data on which to base an opinion, it is still probable that the limit is in the neighborhood of 16 feet deep in the clear, as beyond this the light is rather bad, and the space loses in value in consequence. This consideration limits the useful size of a lot since it will be readily seen that there is a point where the extra size can only be used for court space or in uselessly increasing the size of the offices.

Referring now to figures 1 to 7, we make practical application of these principles. They are intended primarily as suggestive of the plan, and would seem to be the logical outcome of the

* In their layout the need to use the stairs as a hatchway for the introduction of large or awkward articles of furniture should be kept in mind and the strings carried to the wall supporting the stairs, making the newels and rails low so that they shall be as little in the way as possible.

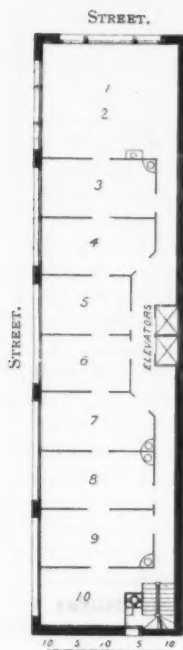


FIG. 1.—25 x 100 building on a corner. Office unit 9.9 x 19.0.



FIG. 2.—25 x 100 building in interior of block. Office unit 8.6 x 12.0.

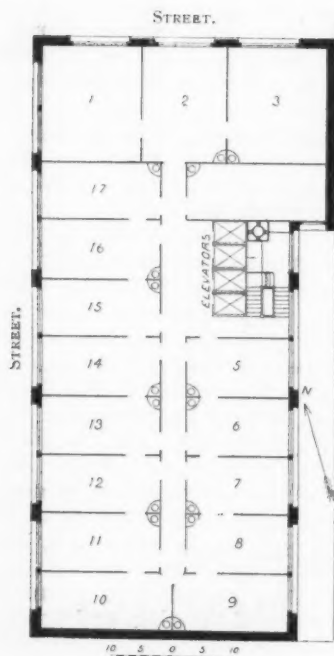


FIG. 3.—50 x 100 building on corner. Office unit 9.9 x 17.0.

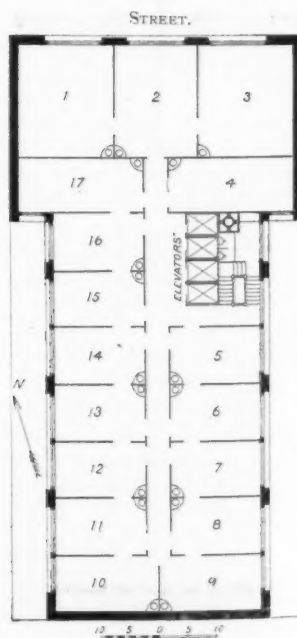


FIG. 4.—50 x 100 building in interior of block. Office unit 9.9 x 15.0.

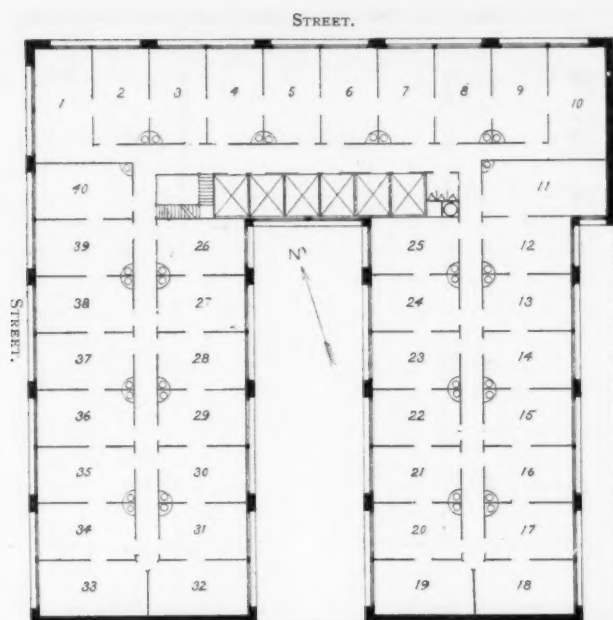


FIG. 5.—100 x 100 building on corner. Office unit 9.9 x 15.0.

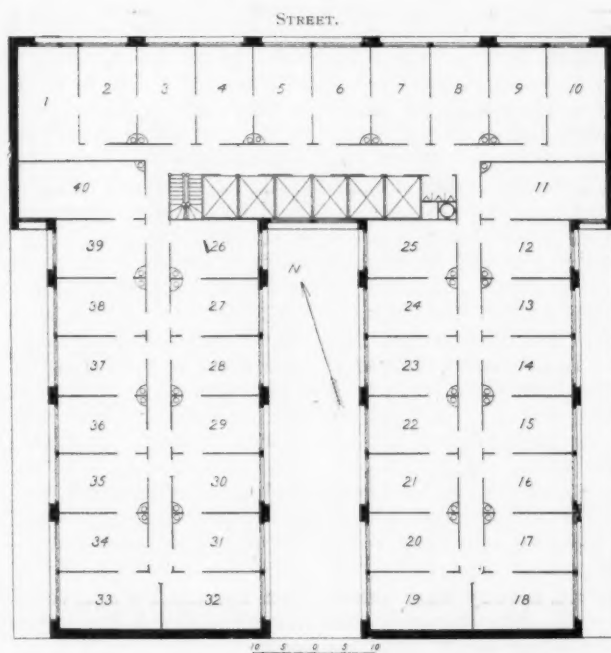


FIG. 6.—100 x 100 building in interior of block. Office unit 9.9 x 15.0.

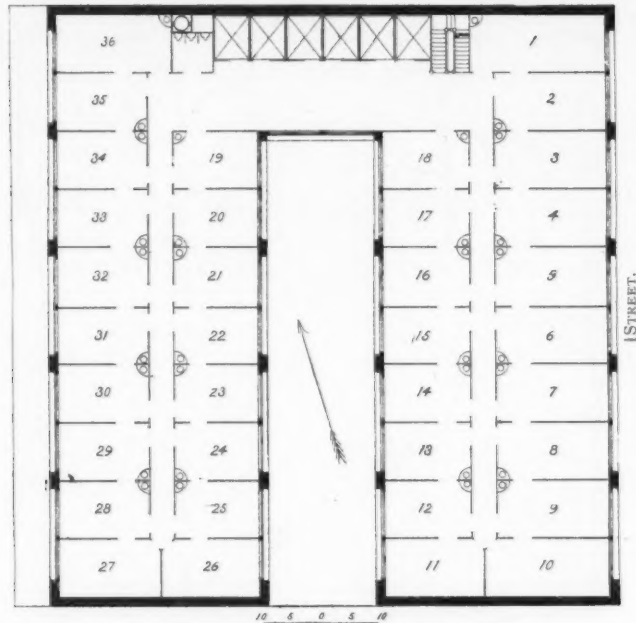


FIG. 7.—Alternative of Fig. 6. Office unit 9.9 x 15.0.

conditions assumed. In them the toilets needed, if there is to be accommodation on each floor, are left out, but if they are decided upon they can be readily arranged for. If they are to be placed on the top floor with the janitor's quarters they can be easily arranged for there, and with the janitor's quarters will occupy about the space they would occupy alone if scattered through the building.

No drawing is made for a 75x100 feet lot, as this size gives no advantage over the 50x100 feet size, except in giving ample light courts and permitting of a slight enlargement of the offices. If good light must be assured as suggested under heading (b), where speaking of the 50x100 feet lot, it would seem to be desirable to extend the frontage and widen the courts, as given in figures 3 and 4, so as to secure the additional light. These plans are for the average thickness of wall for a steel skeleton and would, of course, require a modification if they were made to conform to the requirements for masonry. This has not been done, as it will subsequently appear that the skeleton is the proper method to use.

Second: *The method of construction.*—To put it in the form that it presents itself to us would be to say, steel skeleton versus masonry. The elements that must decide, if we are to decide intelligently, are numerous and each must be given its proper weight.

We can build either all skeleton or all masonry; we can also, if we please, build a masonry wall carrying only itself, and then place columns behind it to carry the loads, but this does not seem to be the best construction since it wastes money, wastes space and will surely lead to some very ugly cracks that never can be closed. It may possess some advantages but they are not easily apparent. The better way would be to do all of either one thing or the other. Taking, then, for consideration the alternative, all masonry or all skeleton construction, we must consider that the masonry, if the walls are built of the thicknesses required by the New York laws, will take up more space than the steel walls, the amount being given in table I,* for all walls from one

*The various figures in the tables have been largely read from the slide rule and will not, therefore, be accurate in the last place, but are sufficiently so for all practical purposes.

TABLE I.

DATA FOR COMPARISON OF BRICK AND STEEL SKELETON WALLS. BASED ON A LENGTH OF ONE FOOT.

STORIES.	HEIGHT.	AREAS.		COSTS.		EXCESS OF COST.	INTEREST AT 8%.	AREA SAVED.	RENT TO PAY INTEREST.
		Brick.	Steel.	Brick.	Steel.				
1	12.5	1.00	1.00	\$4.00	\$6.25	\$2.25			
2	25.0	2.00	2.00	8.00	14.80	6.80			
3	37.5	3.00	3.00	12.00	25.70	13.70			
4	50.0	5.00	4.00	19.00	40.50	21.50	\$1.72	1.00	\$1.72
5	62.5	6.00	5.33	24.00	58.00	34.00	2.72	0.67	4.06
6	75.0	8.67	6.67	34.68	78.68	44.00	3.52	2.00	1.76
7	87.5	11.67	8.00	46.68	103.30	56.62	4.53	3.67	1.23
8	100.0	14.67	9.33	58.68	130.52	71.84	5.75	5.34	1.07
9	112.5	17.33	11.00	69.32	160.75	91.43	7.31	6.33	1.15
10	125.0	20.00	12.67	80.00	193.73	113.73	9.10	7.33	1.24
11	137.5	23.00	14.33	92.00	229.92	137.92	11.03	8.67	1.28
12	150.0	26.00	16.00	104.00	268.95	164.95	13.20	10.00	1.32
13	162.5	29.33	18.00	117.32	321.15	203.83	16.31	11.33	1.43
14	175.0	32.67	20.00	130.68	357.25	226.57	18.13	12.67	1.43
15	187.5	36.33	22.00	145.32	406.90	261.58	20.93	14.33	1.46
16	200.0	40.00	24.00	160.00	459.35	299.35	23.95	16.00	1.50
17	212.5	43.67	26.33	174.68	515.77	341.09	27.29	17.34	1.57
18	225.0	47.33	28.67	189.32	571.66	382.34	30.59	18.66	1.64
19	237.5	51.33	31.33	204.32	633.32	429.00	34.32	20.00	1.71
20	250.0	55.33	34.00	221.32	697.00	475.68	38.05	21.33	1.77

Thickness of walls from the New York Building Laws.

Areas given are for the total number of floors set opposite them. The areas given in columns 3 and 4 are the total areas occupied by the walls on all of the floors, in square feet.

TABLE II.

BUILDING ON CORNER, 25X100.

STORIES.	WALL AREAS.		SERVICE.	TOTAL AREA.	NET AREAS.		COST BUILDING.		COST LOT.	
	Brick.	Steel.			Brick.	Steel.	Brick.	Steel.	Brick.	Steel.
1	250	250	470	2,500	1,780	1,780	\$26,000	\$26,550	\$7,400	\$6,850
2	500	500	940	5,000	3,560	3,560	37,370	39,050	29,330	27,650
3	750	750	1,410	7,500	5,340	5,340	48,800	52,200	51,250	47,800
4	1,250	1,000	1,880	10,000	6,870	7,120	58,900	64,000	70,100	69,500
5	1,500	1,330	2,350	12,500	8,650	8,820	68,900	77,400	93,100	88,100
6	2,170	1,665	2,820	15,000	10,010	10,515	78,800	89,800	108,700	107,200
7	2,950	2,000	3,290	17,500	11,260	12,210	91,700	105,850	118,400	122,950
8	3,660	2,300	3,760	20,000	12,580	13,940	101,800	119,800	134,200	142,200
9	4,330	2,750	4,230	22,500	13,940	15,520	113,000	135,700	149,000	155,300
10	5,000	3,160	4,700	25,000	15,300	17,140	123,950	152,150	162,050	168,850
11	5,750	3,590	5,170	27,500	16,580	18,740	134,900	169,200	175,100	181,800
12	6,500	4,000	5,640	30,000	17,860	20,360	147,300	188,500	187,700	193,500
13	7,250	4,500	6,110	32,500	19,140	21,890	157,264	208,264	200,736	201,736

TABLE III.

BUILDING ON INTERIOR OF BLOCK, 25x100.

STORIES.	WALL AREAS.		SERVICE	TOTAL AREA.	NET AREA.		COST BUILDING.		COST LOT.	
	Brick.	Steel.			Brick.	Steel.	Brick.	Steel.	Brick.	Steel.
1	250	250	800	2,500	1,450	1,450	\$22,700	\$23,280	\$4,500	\$3,920
2	500	500	1,600	5,000	2,900	2,900	31,650	33,350	22,650	20,950
3	750	750	2,400	7,500	4,350	4,350	40,650	44,070	40,850	37,430
4	1,250	1,000	3,200	10,000	5,550	5,800	50,000	55,100	54,000	53,700
5	1,500	1,350	4,000	12,500	7,000	7,170	58,850	67,350	72,350	67,150
6	2,170	1,665	4,800	15,000	8,030	8,535	68,780	79,790	81,220	80,210
7	2,950	2,000	5,600	17,500	8,950	9,900	79,200	93,350	87,800	92,050
8	3,660	2,300	6,400	20,000	9,940	11,300	89,600	107,600	96,900	104,400
9	4,330	2,750	7,200	22,500	10,970	12,550	99,600	123,300	106,000	111,700
10	5,000	3,160	8,000	25,000	12,000	13,840	108,650	136,850	116,350	122,650
11	5,750	3,590	8,800	27,500	12,950	15,110	119,600	153,900	123,000	130,100
12	6,500	4,000	9,600	30,000	13,900	16,400	129,000	170,200	131,600	137,000
13	7,250	4,500	10,400	32,500	14,850	17,600	140,300	191,200	137,700	138,800

TABLE IV.

BUILDING ON CORNER, 50x100.

STORIES.	WALL AREAS.		SERVICE.	TOTAL AREA.	NET AREAS		COST BUILDING.		COST LOT.	
	Brick.	Steel.			Brick.	Steel.	Brick.	Steel.	Brick.	Steel.
6	2,601	2,001	5,550	30,000	21,850	22,450	\$131,100	\$144,300	\$276,900	\$276,700
7	3,401	2,400	6,475	35,000	25,125	26,125	152,400	169,300	318,600	318,700
8	4,401	2,799	7,400	40,000	28,200	29,800	173,400	194,900	354,600	363,100
9	5,199	3,300	8,325	45,000	31,775	33,375	199,000	216,500	396,000	408,500
10	6,000	3,801	9,250	50,000	34,750	36,950	220,200	253,900	430,800	438,100
11	6,900	4,299	10,200	55,000	37,900	40,500	241,550	292,850	469,450	465,150
12	7,800	4,800	11,150	60,000	41,050	44,050	265,250	314,750	504,750	510,250
13	8,799	5,400	12,100	65,000	44,100	47,500	287,550	348,550	537,450	541,450
14	9,801	6,000	13,050	70,000	47,150	50,950	314,900	383,400	567,100	571,600
15	11,899	6,600	14,000	75,000	49,100	54,400	338,650	416,950	581,350	603,050
16	12,000	7,200	15,000	80,000	53,000	57,800	364,600	453,600	628,400	630,400
17	13,101	7,899	16,000	85,000	55,900	61,100	388,500	490,700	659,500	652,300
18	14,199	8,601	17,000	90,000	58,800	64,400	412,700	527,550	687,300	677,450
19	15,399	9,399	18,000	95,000	61,600	67,600	437,650	566,450	714,350	703,550
20	16,599	10,200	19,000	100,000	64,400	70,800	463,350	606,350	743,650	721,650

TABLE V.

BUILDING ON INTERIOR OF BLOCK, 50X100.

STORIES.	WALL AREAS.		SERVICE.	TOTAL AREA	NET AREA.		COST BUILDING.		COST LOT.	
	Brick.	Steel.			Brick.	Steel.	Brick.	Steel.	Brick.	Steel.
6	2,601	2,001	8,400	30,000	19,000	19,600	\$119,200	\$132,400	\$236,800	\$234,600
7	3,401	2,400	7,800	35,000	21,800	22,800	139,450	156,350	268,550	270,650
8	4,401	2,799	11,200	40,000	24,400	26,000	154,430	175,900	262,570	311,100
9	5,199	3,300	12,600	45,000	27,200	29,100	181,850	209,350	328,150	335,650
10	6,000	3,801	14,000	50,000	30,000	32,200	203,450	237,150	359,550	366,850
11	6,900	4,299	15,430	55,000	32,670	35,270	223,000	264,300	390,010	397,700
12	7,800	4,800	16,860	60,000	35,340	38,340	245,800	295,300	416,200	422,700
13	8,799	5,400	18,290	65,000	37,910	41,310	266,500	327,500	443,500	447,500
14	9,801	6,000	19,720	70,000	40,480	44,280	293,200	361,700	466,800	468,300
15	11,899	6,600	21,150	75,000	41,950	47,250	314,300	392,600	470,700	494,400
16	12,000	7,200	22,650	80,000	45,350	51,050	338,450	427,450	511,550	328,550
17	13,101	7,899	24,150	85,000	47,750	52,950	361,650	463,850	535,350	536,150
18	14,199	8,601	25,650	90,000	50,150	55,750	384,600	499,400	555,400	545,600
19	15,399	9,399	27,150	95,000	52,450	58,450	408,100	538,900	573,900	558,100
20	16,599	10,200	28,650	100,000	54,750	61,150	431,650	574,650	593,350	567,350

TABLE VI.

BUILDING ON CORNER, 100X100.

STORIES.	WALL AREAS.		SERVICE	TOTAL AREAS.	NET AREA.		COST BUILDING.		COST LOT.	
	Brick.	Steel.			Brick.	Steel.	Brick.	Steel.	Brick.	Steel.
6	4,670	3,600	17,700	60,000	37,630	39,700	\$208,450	\$232,250	\$497,550	\$511,750
7	6,300	4,320	20,650	70,000	43,050	45,080	242,550	273,150	567,450	571,850
8	7,900	5,050	23,600	80,000	48,500	51,350	276,950	315,750	633,050	644,250
9	9,350	5,940	26,550	90,000	54,100	57,510	311,750	361,250	700,250	708,750
10	10,800	6,840	29,500	100,000	59,700	63,660	346,300	407,300	771,700	783,700
11	12,400	7,700	32,450	110,000	65,150	69,850	389,200	463,700	831,800	844,300
12	14,100	8,640	35,400	120,000	70,500	75,960	426,800	515,900	863,200	904,100
13	15,800	9,720	38,350	130,000	75,850	81,930	462,350	572,350	957,650	959,650
14	17,670	10,800	41,300	140,000	81,030	87,900	500,650	621,750	1,019,350	1,026,250
15	19,600	11,860	44,250	150,000	86,150	93,890	546,400	687,400	1,068,600	1,070,600
16	21,600	12,950	47,200	160,000	91,200	99,850	586,600	746,750	1,123,400	1,123,250
17	23,600	14,150	50,150	170,000	96,250	105,700	626,800	811,000	1,173,200	1,169,000
18	25,500	15,500	53,100	180,000	101,400	111,400	668,200	874,200	1,239,800	1,215,800
19	27,700	16,900	56,050	190,000	106,250	117,050	709,400	941,400	1,280,600	1,248,600
20	29,800	18,350	59,000	200,000	111,200	122,650	753,900	1,009,900	1,326,100	1,290,100

TABLE VII.

BUILDING IN INTERIOR OF BLOCK ALTERNATIVE FIG. 6.

STORIES.	WALL AREAS.		SERVICE	TOTAL AREA.	NET AREA.		COST BUILDING.		COST LOT.	
	Brick.	Steel.			Brick.	Steel.	Brick.	Steel.	Brick.	Steel.
6	4,650	3,600	21,000	60,000	34,350	35,400	189,950	215,000	454,050	448,000
7	6,300	4,300	24,500	70,000	39,200	41,200	219,000	250,000	516,000	523,000
8	7,900	5,050	28,000	80,000	44,100	46,950	251,000	291,000	577,000	589,000
9	9,350	5,940	31,500	90,000	49,150	52,560	286,000	335,000	634,000	652,000
10	10,800	6,840	35,000	100,000	54,200	58,160	319,000	384,000	696,000	706,000
11	12,400	7,700	38,500	110,000	59,100	63,800	353,500	433,000	756,500	765,000
12	14,100	8,640	42,000	120,000	63,900	69,360	390,000	484,000	808,000	816,000
13	15,800	9,720	45,500	130,000	68,700	74,780	421,900	538,000	869,000	867,000
14	17,670	10,800	49,000	140,000	73,330	80,200	457,000	587,000	915,000	923,000
15	19,600	11,800	52,500	150,000	77,900	85,700	497,000	648,000	964,000	962,000
16	21,600	12,950	56,000	160,000	82,400	91,050	536,000	708,000	1,009,000	1,000,000
17	23,600	14,150	59,500	170,000	86,900	96,350	574,000	771,000	1,056,000	1,039,000
18	25,500	15,500	63,000	180,000	91,500	101,500	611,000	833,000	1,109,000	1,067,000
19	27,700	16,900	66,500	190,000	95,800	106,600	648,000	895,000	1,152,000	1,105,000
20	29,800	18,350	70,000	200,000	100,200	111,650	690,000	964,000	1,190,000	1,126,000

TABLE VIII.

BUILDING IN INTERIOR OF BLOCK ALTERNATIVE FIG. 7.

STORIES.	WALL AREAS.		SERVICE	TOTAL AREA.	NET AREA.		COST BUILDING.		COST LOT.	
	Brick.	Steel.			Brick.	Steel.	Brick.	Steel.	Brick.	Steel.
6	5,000	3,850	23,100	60,000	31,900	33,050	\$189,950	\$215,450	\$407,050	\$404,550
7	6,750	4,650	26,950	70,000	36,300	38,400	219,200	252,000	460,800	468,000
8	8,550	5,400	30,800	80,000	40,650	43,800	251,500	293,100	509,500	526,900
9	10,100	6,350	34,650	90,000	45,250	49,000	283,600	336,600	565,400	581,400
10	11,600	7,350	38,500	100,000	49,900	54,150	319,800	385,800	616,200	625,200
11	13,350	8,300	42,350	110,000	54,300	59,650	354,350	434,350	663,650	683,650
12	15,100	9,250	46,200	120,000	58,700	64,550	390,100	486,100	709,900	721,900
13	17,000	10,450	50,050	130,000	62,950	69,500	421,700	539,900	756,300	762,100
14	19,000	11,600	53,900	140,000	67,100	74,500	457,000	588,000	800,000	807,000
15	21,000	12,750	57,750	150,000	71,250	79,500	497,550	649,150	827,450	838,850
16	23,200	13,900	61,600	160,000	75,200	84,500	536,650	710,650	873,350	871,350
17	25,400	15,250	65,450	170,000	79,150	89,300	575,300	773,300	906,700	897,700
18	27,400	16,600	69,300	180,000	83,300	94,100	612,700	834,700	947,300	927,300
19	29,700	18,200	73,150	190,000	87,150	98,650	649,750	897,750	982,250	952,250
20	32,000	19,700	77,000	200,000	91,000	103,300	690,900	965,900	1,014,100	972,100

EXPLANATION OF TABLES.

As an example of the use of the tables I. to IX., we will suppose the case of a lot 90x100 placed on a corner; then to determine the available floor space for any given number of stories, we would refer to columns 3 and 4 of table I.

If we were thinking of a building ten stories high with brick masonry walls, we would multiply the perimeter of the building by 20, the number of square feet occupied in a ten-story building by a wall 1 foot long, and this would give us the total area occupied in the ten stories of the building, by the walls.

Similarly, if we multiply by 12.67, we would have the total area occupied by a steel skeleton building.

Next, suppose that we desire to know which of these two buildings would be the least expensive to erect, columns 5 and 6 give the respective costs per lineal foot of wall of a brick building or a steel skeleton building.

Column 7 gives the excess of cost, one over the other—this amounts to \$113.73.

Now refer to column 9. It will be seen that the skeleton method saves 7.33 square feet over the masonry method.

If then we can rent this 7.33 square feet at \$1.24 per square foot, which is taken from column 10, we will pay interest at 8 per cent on the additional cost of the steel skeleton wall; and if our rents are \$1.25 per square foot, or more, it will be better economy to build the steel skeleton than to build the masonry wall.

Column 10 of table I. also shows that an eight-story building with a steel skeleton frame is the most economical considered only in the light of what it costs to gain the additional floor space; if we can rent that floor space for \$1.07 it will pay interest on the additional cost.

Continuing the example of the 90x100 lot, if it should be desired to determine what could be done with it, refer to table VI.

The areas occupied by the wall given in columns 1 and 2 will be almost the same.

If an exact figure is desired, it can be obtained by the use of column 3 and 4 of table I.

The area occupied by the service will be precisely the same, except that the end of the hall will be cut off.

The net area will be reduced by 4 office units or 600 square feet per story. Then we would subtract these areas from the net areas given in column 6 or 7 for the actual net area of the building, multiplying by the rental per square foot determined on as a proper amount, would give the gross return per annum from the building. Capitalizing this at 8 per cent would give the amount of the total investment which is possible under the circumstances. This total investment includes the cost of the building as given in columns 8 and 9, and must further include interest on the investment for one year of amounts paid for architects and other commissions, purchasing of leases, tearing down of old buildings, and such other matters not properly included in the cost of a building.

These values are given in columns 10 and 11 for the different regular size lots. This limitation usually amounts to in the neighborhood of 10 per cent on the total investment, and should be very carefully observed.

Table IX is used as follows: Suppose that a man should offer a lot 50x100 for \$300,000 on the interior of a block. Referring to table IX, columns 8 and 9, it will be seen that the building must be eight stories or more in height, since the allowable price per square foot does not reach \$60.00 per square foot, which is the price of the lot per square foot based on \$300,000, until eight stories have been reached, for a steel skeleton building.

Similarly, if the offer was for a lot of 50x100 at \$1,000,000 it would be necessary to increase the rental price per square foot up to \$2.00, to put the building on the corner, and build in steel skeleton, in order to be able to pay 8 per cent, inasmuch as the highest price that can be paid per square foot for a lot 50x100 on a corner is \$148.73, when the rents are \$1.50 per square foot, and the owner is satisfied with a gross 8 per cent return.

to twenty stories in height. Then, if the building is placed on a very narrow lot we must have some bracing, and the masonry walls do not readily lend themselves to this. No doubt it could be done, but it is probable that it would be far from a satisfactory piece of work and would probably lead to serious trouble in the future. Finally, we have the actual cost of the two methods when we place the interest of the added cost of the skeleton method against the lost space of the masonry method. This has been carried out to a legitimate conclusion for the several sizes of buildings and for the various heights in Tables II. to VIII., in which are given the areas occupied by the walls, the halls, elevators, toilets and service generally, under the heading of service: The total area obtained by multiplying the area of lot by the number of stories, the net area, the cost of the building and the maximum cost of the lot for both brick and steel buildings of various sizes of lot and varying heights.

In table IX. the lot costs have all been reduced to a price per square foot for purposes of comparison.

This maximum lot cost is obtained by multiplying the net rentable area by \$1.50—assumed to be a fair average rentable value for the space, giving the gross income. This was capitalized at 8 per cent on the assumption that 3 per cent would easily cover all expenses for service, maintenance, etc., leaving 5 per cent as the net income. From the capital account so obtained the cost of the building was deducted, leaving the balance as the maximum amount that can be spent for the lot, plus interest cost for one year, fees, buying leases, etc. Of course, when the lot cost is actually less, there will be a corresponding greater profit.

Table I. shows under what conditions of rental value it is profitable to build the skeleton, viz., between six and seventeen stories when the rents are \$1.50 per square foot, as assumed, and between four and twenty stories if they average \$1.77.

If the front and rear walls are not too much pierced it might be safe to

build with such bracing as could be had in masonry, but it would not be positively so.

Should the rentable value be greater or less than that shown, a new value for the lots can be found by multiplying the net area for the number of stories given, dividing the result by 0.08 and subtracting from the amount so obtained the cost of the building.

The costs as given are the result of a careful analysis of the costs of the buildings made in detail for each building and are based on New York prices; they include everything needed to fit the building for occupation, including fixtures, mechanical plans, etc., complete; they will be found to be close enough to require care to reach them, and do a thoroughly first-class piece of work in New York, while for other cities in the East they will be found to be ample.

It must be kept in mind that to accomplish these results, the space devoted to service must be laid out according to the principles already given, that the construction should follow the limitations given under heading (g), and that if there are to be spacious halls, monumental stairways, etc., there will also be a grand increase in cost and decrease in space.

(f) *Ease of re-arrangement.*—This is one of the items of cost that rarely enters into the preliminary estimates and is often of serious proportions. If the offices are laid out as advised much of this trouble will be avoided and if the partitions are made with corrugated iron lath, plastered on both sides with rock plaster and stiffened by being secured to small I beams, they can be shifted around at will with a minimum of cost. All of the other constructions will remain undisturbed and ready for any desired number of changes.

(g) *Minimum of cost consistent with economy.*—It would be probably well to again call attention to the tables II. to VIII. and to their lesson, that there are certain lots that, taken alone, cannot probably be made to pay interest on the cost of any building and the value of the lot no matter what the building be. This would not be so were we free to go to any height with the building, but there is a limit beyond which it is

not safe to go, and it seems to be the proper place to speak of it here. Every tall building is at times subjected to wind pressures, tending to blow it down. We may say that this is a remote evil, but that it is a real one is too evident to be denied. The wind acts against the building in a horizontal direction, so that the building may be considered as being in the same condition as a beam fixed at one end, with the other end free and uniformly loaded. If this were the case actually with a beam, we should make the depth of the beam such that it would deflect less than the amount necessary to crack plaster. If the beam were supported at both ends this depth would be one-twentieth of the span, and being free, the effect of the load would be increased four times. Finally, we know that the length under these two conditions to secure the same deflection must bear the relation one to the other of 0.57 to 1.00. If then we have an office building 25 feet wide and should make the depth one-twentieth of the span, the building would be 500 feet high, and reducing this in the ratio above given makes the height 285 feet. If we had this height and the wall were pressed against the predetermined amount we should have a deflection of 8 to 9 inches, which would throw the centre of gravity of the wall beyond the outer edge of the wall, if the building were eight stories high, and would bring it dangerously close, no matter what the number of stories. Keeping this condition in mind, it is probable that the maximum limit beyond which the deflection would be unpleasant, would be from $2\frac{1}{2}$ to 3 inches, and this would give the height as from 71 to 95 feet, this according fairly well with the current practice. If we work on the assumption that the building is analogous to a beam with one end fixed and the other end free, and make its length one-fourth as great as we would if it were supported at both ends, we should have the depth to the length about as 1 to 5, or the height would be made 125 feet. This slightly exceeds the upper limit, as above found, and if the buildings were free standing, there is but little doubt that between four and five

times the width would be the safe limit to carry the height, where proper regard was had to the wind bracing.

This then gives us limits within which we can make our own selection, depending on the circumstances of the character of the adjoining buildings, character of the soil and the other conditions of the environment. If the adjoining structure was to be some old small building, certain to be replaced in the course of a few years, it might be permissible to go one or two stories higher and watch the bracing when the intermediate building was torn down to see that it was of sufficient stiffness to resist the wind thrust, while if it were similar in character to the new one and equally well braced it would be probably safe to go to the maximum limit given.

In this connection the limit in the methods of construction imposed by the bracing must be observed even when it increases the cost of the building by the use of the steel type when the height goes beyond the economical limit for this construction.

It will then be apparent that when the space rents for \$1.50 per square foot, a masonry building pays up to about six stories, and beyond that it is necessary to build in steel. Since it is always desired to build to make the maximum possible return, we can treat the building as of a skeleton type, and enumerate the proper materials to use to meet the final conditions. It should be said that the estimates heretofore given are based on these materials, and the deductions therefrom will be varied slightly if the material change. It should also be said that only a first-class piece of work is contemplated, and not such as could be put up by a speculator in order to fill the building with tenants and then sell out to some easily gulled outsider.

In the choice of material, while there is, in some cases opportunity for a choice yet it will be found to be much more restricted than is generally supposed, and there are certain points in which there is none. It will not be attempted to give reasons but simply to indicate what experience and good practice have shown to be necessary.

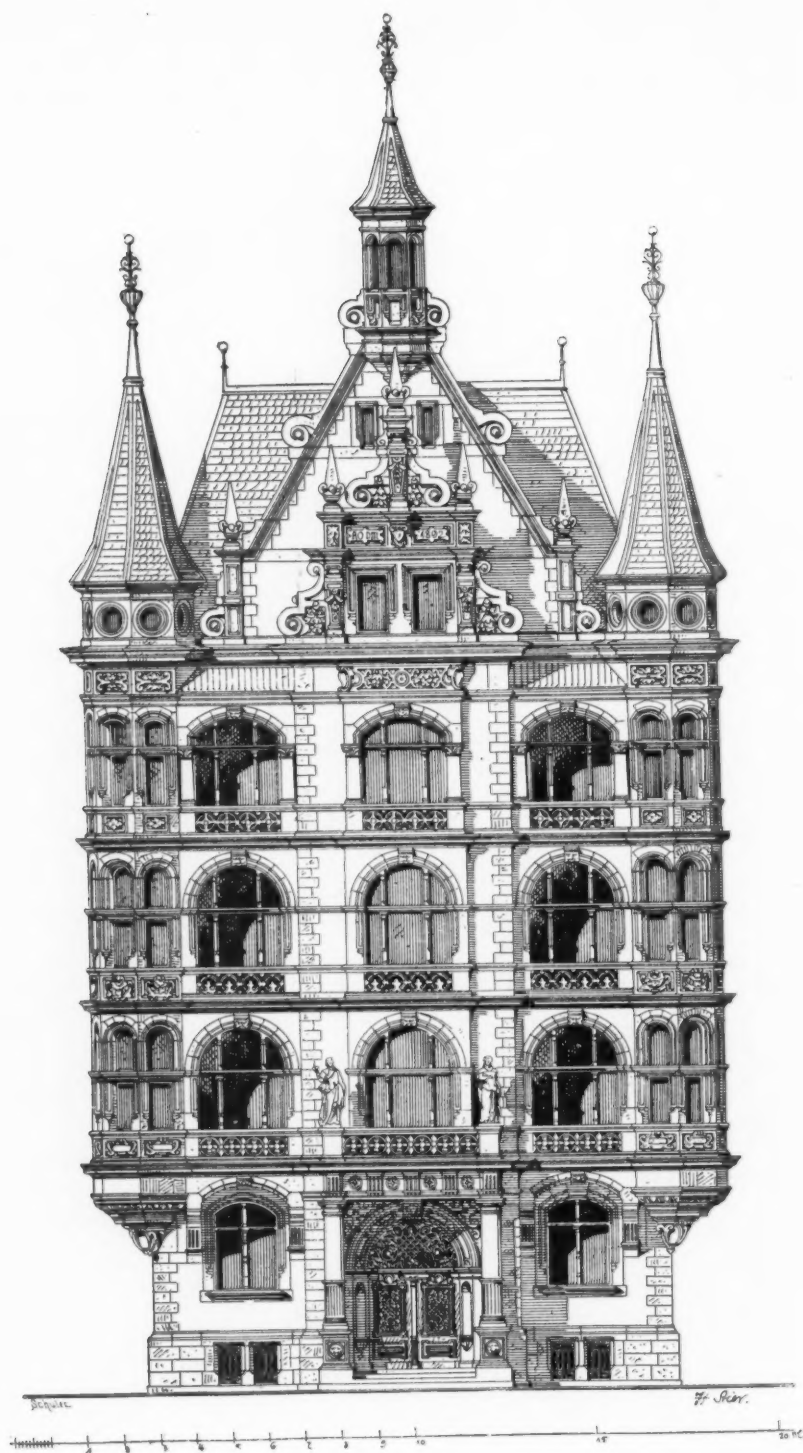


Chicago, Ill:

ASHLAND BUILDING.

Burnham & Root, Architects.

Vol. II —4.—6.



RESIDENCE IN HANOVER.

Prof. H. Stier Architect.



West Madison street, Chicago, Ill.

A. J. STONE BUILDING.

Alfred Smith, Architect.

The frame should be of mild steel, columns, girders, beams, etc., using the usual commercial shapes. The various parts should be rivetted together and the column connections so made as to maintain the full strength of the column.

The walls should be made with buff brick and terra cotta fronts and common brick backing for the facades, with the stories forming the basement of stone if desired, although this requires a judicious selection of the stone. The rear walls should be made with common brick and the courts either lined with enamel brick and with the beds and builds made flat, which would be the case wherever the courts are internal ones, or else painted three coats of paint finishing with one coat of enamel paint. The facing brick, where of a different size from the backing, should have every brick anchored with a Morse wall tie as often as the courses fall even. The inner faces of the walls that are exposed to the weather should be furred, using the usual two-inch furring blocks, the usual hollow bricks of Haverstraw size having proved to be a delusion so far as excluding moisture goes.

The fireproofing may be either of the hollow flat arches familiar to all, or of the new Manhattan type, either having proved to be good. The blocks, if used, should be so used as to fill up nearly the entire space between the flanges of the beams so as to require the minimum of filling, and the pipes and wires run in shallow channels run in the under flooring. The columns should be fire-proofed either by the use of slabs of fire clay, each slab securely wired to the others in the course, or else the column should be outlined with small L's and wire lath stretched over and plastered thoroughly, the writer's preference being for the wire lath and plaster. Every portion of the frame should be so treated, including the columns that are so laid out as to aid in the wind bracing and especially covering all columns that are inclosed in stone. If the framing is carefully laid out the beams will so come that it will be practicable to show them, using either high skew backs or the Manhattan arches

without the hung ceiling below, thus effecting a small economy in cost.

The flooring in the halls should be either a marble mosaic or else a granolithic laid with a marble border, there being a small difference in favor of the granolithic. The toilets should be similarly treated. In the offices the flooring should be of Georgia yellow pine left untreated, but of course mill-dressed and carefully laid.

The plastering should be a rock plaster, hard finish, with the plaster carried into all jambs and reveals, with the corners rounded off, and a small cove at the ceiling, say of 6-inch radius. The partitions should be made of a rock plaster, put on corrugated iron lathing supported at intervals of about 3 feet by means of small channels or I's secured to the floor arches above and below. These partitions are but 2 inches thick, can be easily removed, and should be somewhat cheaper than the ordinary 4-inch blocks.

The trim should be of white oak, filled, hard oiled and rubbed to an eggshell finish, the base being made about $1\frac{1}{4}$ x 8 inches and the architraves about 4 inches wide over all, with a backing and back mold carried down to the floor, affording something for the base to stop against and mitreing around all openings. The window trim would be similar in character, with the inner moulding carried around across the top of the base and under the stool cap, so as to form a small panel under the sill. Chair rails and picture mouldings are matters of choice, and the former is seldom of any great use.

The halls should have either a Keene's cement or Mycenian marble wainscot, with marble base and cement cap, or the rock plaster can be run for a cap and a marble base put in, and then the space between painted with an enamel paint.

The toilets should have the water-closet partitions made of oak carried about 10 inches above the floor on brass legs, the urinal stall should be made of marble and the urinals either the long-lipped urinal with the "Parsons" flushing tanks for each stack, or else Mott's "Shanks" patent with individual tank. The water-closets should be



PRUDENTIAL LIFE INSURANCE COMPANY'S BUILDING.

Newark, N. J.

George B. Post, Architect.

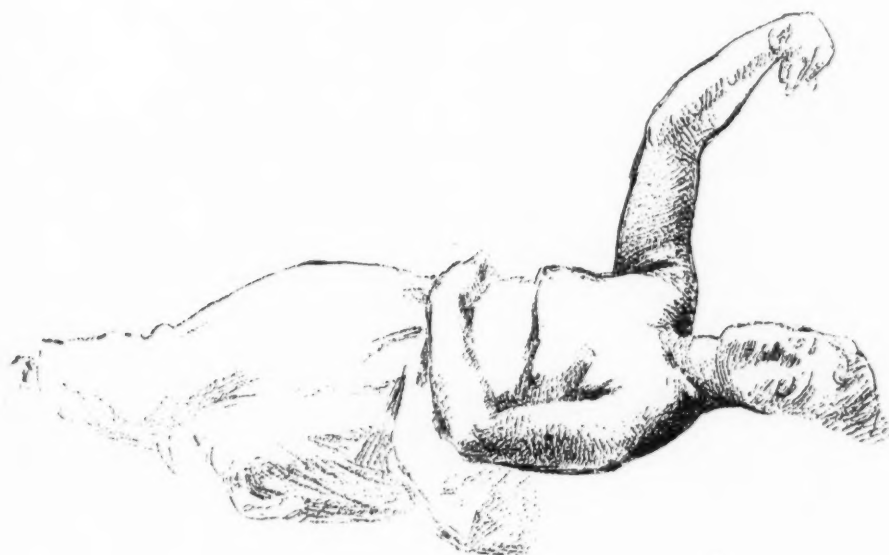
either a washout closet or else a pedestal hopper with the seat simply a wooden rim carried on brass brackets, and a copper-lined wood cistern. The wash-basins should be oval with the patent overflow and half S traps close under the fixture with the supply pipes placed close under the slab and with shut-off cocks for each one.

Miscellaneous.—The roofing should be the New patent, the glazing of polished plate glass; the painting should be of the most thorough order, using for the first coats of all metal work a paint made by mixing 18 lbs. of red lead with 5 lbs. of raw linseed oil and applying while freshly mixed, the remaining painting being of first-class

lead and oil paints in four coats. Leaders and flashing all of copper, skylights of galvanized iron, and the balance of the work to correspond.

It is of course impracticable in a single article to cover all of the ground, giving reasons for many of the statements made and going into the detail that would be desirable for a complete treatise on the subject. Those who desire to pursue it further will find the general principles of the constructive part fully treated in the writer's book, "Office Help for Architects," now appearing in the *American Architect*, and the details will be fully treated in a book the writer now has in preparation on this subject.

George Hill.





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CHICAGO ATHLETIC ASSOCIATION BUILDING.

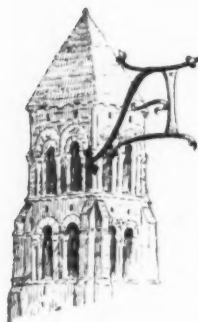
Michigan avenue, Chicago, Ill.

H. Ives Cobb, Architect.



ARCHITECTURAL ABERRATIONS.*

No. 7.—THE FAGIN BUILDING, ST. LOUIS.



N eminent sculptor has been heard, home returning from Philadelphia, soothly to swear that it was something to have seen the worst in any kind, and that in Philadelphia he had seen the exactly worst piece of architecture in existence, in the *Record* building. It may be worth while to reverse Matthew Arnold's maxim and in the interest of culture to know the worst that has been done in the world, but one is always prone to puff himself up with the belief that he knows it when in fact he does not. We have already dealt in this series with the *Record* building and we shall not be suspected of entertaining any mawkish tenderness for that structure. But if the sculptor we have quoted had been confronted, just after delivering his judgment with the Fagin building of St. Louis, how would he have deplored his temerity!

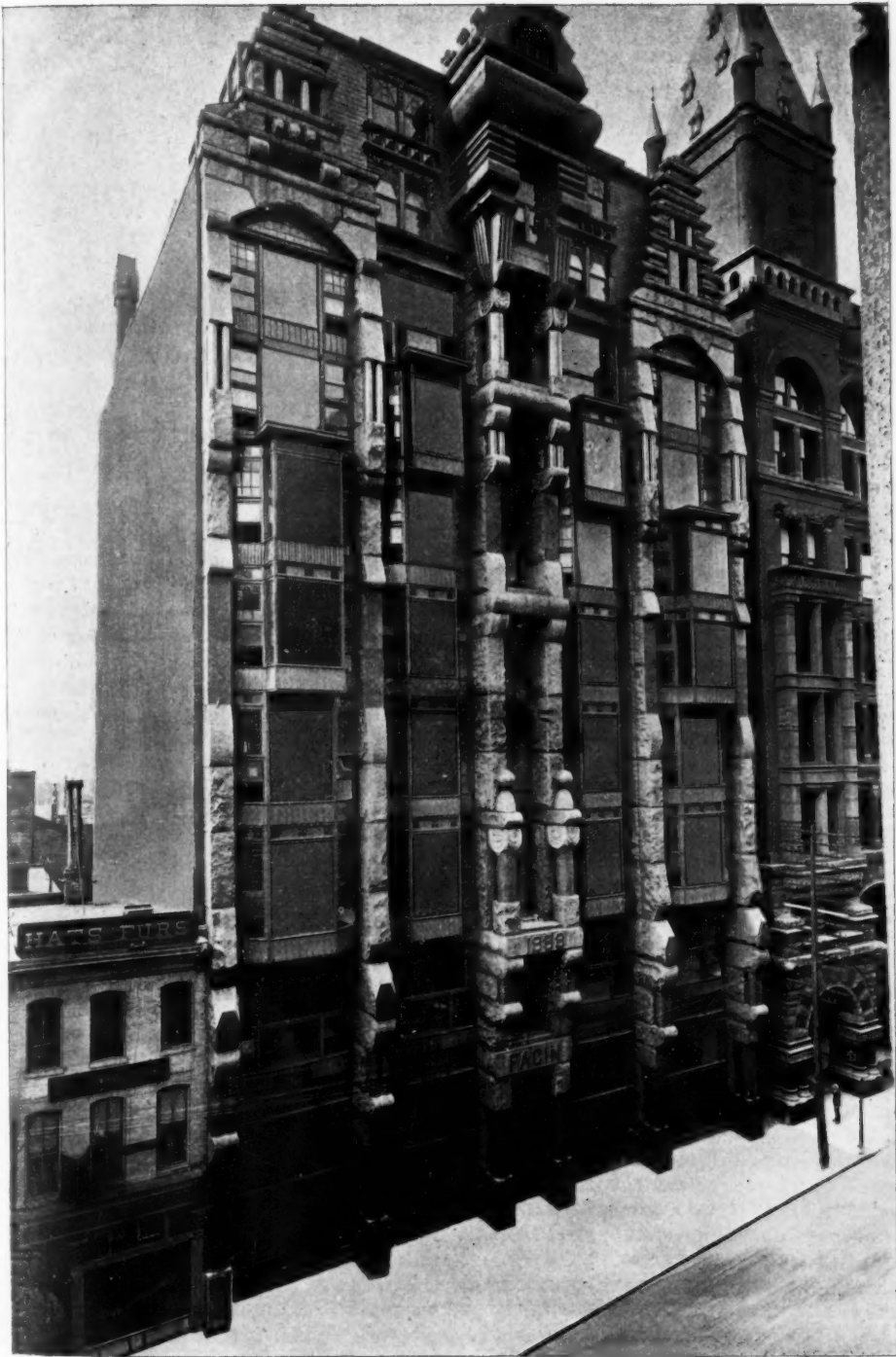
"Ah! where shall we go then for pastime,
If the worst that can be has been done."

It may be apprehended that there will be a good deal of fun hereafter in Philadelphian architecture, even though the *Record* building "has been done,"

and perhaps some future architect of St. Louis may exceed the absurdity of the Fagin building. We cannot say that it is the worst that can be, but can anybody indicate anything quite so bad that has been? If so, he will confer a favor by sending a photograph of the object in question to join the collection of yet unpublished aberrations.

In such a structure as this (if there be on the whole planet another such) the psychological problem early arises: What can have been in the man's mind when he did it? What did he think he thought? An architect in Baltimore, upon whose work we had occasion to comment not long ago, delivered himself into our hand, though we refrained from administering further justice upon him, with the defense that it was necessary to make a commercial building conspicuous and to arrest the attention of the passer. This intention to "collar the eye" is visible in all the aberrations of our architecture. Whether it proceed from personal vanity on the part of the designer or from deference to the requirements of his clients, it is essentially a vulgar motive and cannot have other than a vulgar result. When complicated with ignorance sufficiently dense, or with unsoundness of mind, it produces architectural aberrations. It is plain enough that the designer of the Fagin

* We are making a collection of "Aberrations," and shall present one to our readers in each number of THE ARCHITECTURAL RECORD.



THE FAGIN BUILDING, ST. LOUIS, MO.

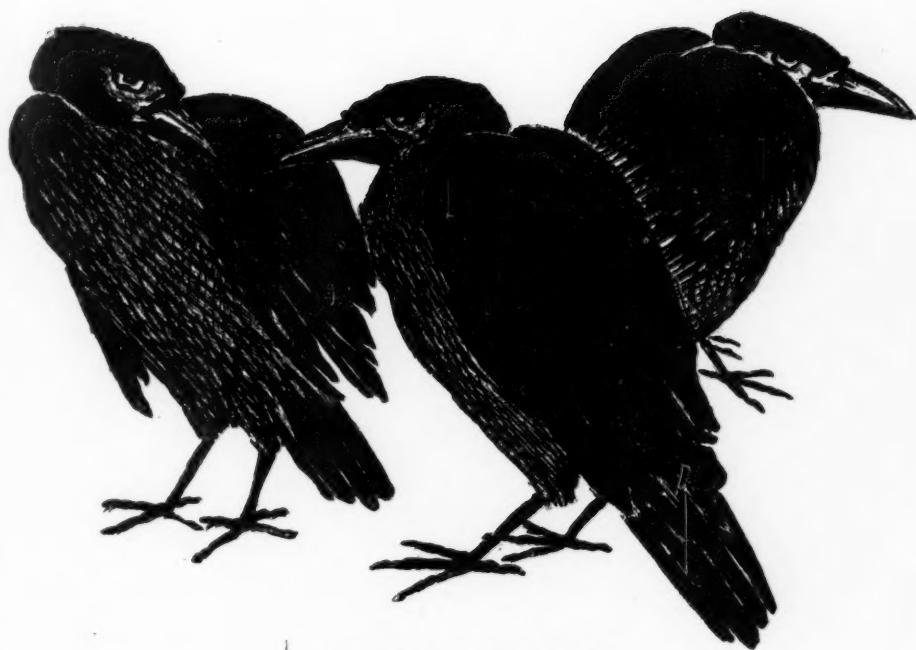
building meant to make people look at his work, and so far he has been successful. Nobody but a blind man who should pass it could possibly escape it. But there is novelty in the method by which he has sought his result. Apparently his notion was, after sacrificing to practicality by making a front that is nothing but a sash-frame, to produce an architectural work by making the sash-front look massive. The thing is impossible, of course. Although by skillful treatment an architect may mitigate his misfortunes and make the utmost of inadequate dimensions, a massive sash-frame is beyond his powers, and a cyclopean sash-frame, such as the architect of the Fagin building has attempted, is beyond his dreams.

An architect, if for his sins he had to design a front with such a proportion of voids to solids, would have made his basement as solid as possible, have tied his front together with emphatic horizontal lines, and have tried for an expression of lightness and grace, an expression of mass and solidity being out of the question. The designer of the Fagin building, instead of dissembling the unfortunate weakness and tenuity of his supports, has called attention to it by every means in his power. He has projected them from the plane of the front, he has not crossed them with a single horizontal band from the sidewalk to the roof, he has diminished them into shafts at the bottom and left them as boulders above, and he has treated them with the utmost rudeness, as if rudeness and vigor were the same thing, and slovenliness, profanity and profuse expectoration signs of force of character. The comparison is not inapt, for protruding rough stones and leaving capitals and bases off from columns is analogous to going about in one's shirt sleeves and with unblackened boots. It is a disregard of elementary decencies, and such a disregard characterizes the whole design of the Fagin building so that the predominant expression is not so much of crudity or rudeness or mere ignorance, as of impudent rowdyism.

It does not attain its purpose, for it

cannot possibly frighten anybody. In fact, all the efforts to make it look vigorous betray and enhance its pitiable weakness. Six completely independent piers, running through from top to bottom, divide the front into five vertical slices, none borrowing any strength from any other, and all consequently seeming in imminent danger of toppling down. To look at it one would say that a healthy child would have no trouble in kicking it over. Our swash-buckler, so far from being formidable, is "staggering drunk." The apparent instability of equilibrium that would be in any case produced by the erection of the front in vertical slices and without horizontal lines, is aggravated by the fact that the stilts that support it are grievously overloaded at the top. Not only does this top over-weight the sub-structure, but the things of which it is made up are even more outrageous than the detail of the sub-structure, which one would say was impossible if he saw only the sub-structure. The huge cornice of the central slice, the things that support it, the thing it supports, the imitation in the side gables of logs of wood in masonry, the difference between these gables—has the heart of man ever conceived such atrocities elsewhere or before?

Up to date, and so far as we know, the Fagin building is the most discreditable piece of architecture in the United States. In spite of our caution about the superlative degree we are compelled to employ it. This has all the vices and crudities that we call "western," though in fact the geography has nothing to do with them. As we have before remarked, the commercial architecture of Philadelphia is, upon the whole, more western than anything in the West, though there is nothing quite so outrageous in Philadelphia itself as this building in St. Louis. But it is significant, we fear, of the same lack of anything that can fairly be called a public from which Philadelphia suffers that such a defiance of common sense and common decency should be offered to the people of St. Louis as has been offered them in the Fagin building.



✓ THE SECOND SPRING.



THE religious bigotry of the sixteenth and seventeenth centuries, the weakened faith, carelessness and political fanaticism of the eighteenth, together with the abuse through a wrong use of the material employed and the lack of patronage left the glazier's art at the beginning of the present century mutilated and shorn of its beauty—a lifeless thing, apparently beyond resuscitation. It was destined, however, to be born again, to enter upon its Second Spring; the Winter was to pass away and this flower of beauty was to appear once more in the land.

It is my purpose in this paper to show how this Second Spring was brought into being, to briefly recount the history of the road by which the Glazier returned to his proper place in the world of art. All history tells us that colored glass windows are essentially a component part of mediæval

Christian architecture, one of its greatest glories, and that Christian architecture in its turn is one of the component parts of Christian Art, which is nothing more than the manifestation under material forms of the beauty of God as it is mirrored upon the hearts of believing souls, the recitation of the *Credo* under forms of imagery and in lines of beauty. We cannot, therefore, expect to find any branch of Christian Art blooming and flourishing where faith is absent or half-hearted, but only where the atmosphere is charged with the fullness of belief. Faith, devotion, sympathy and encouragement on the part of the people, although necessary, are not enough in order to obtain the best results in any of the walks of Christian Art, it is all important that the artists themselves be imbued with a natural *art sense*, quickened by a strong spirit of piety.

If this be true we may rightly conclude that there never could be a revival or awakening of the glazier's art until these conditions exist once more: a believing people filled with a love for their faith, and willing, like the faithful of the Middle Ages, to make sacri-



Boston, Mass.

GROUP FROM MEMORIAL WINDOW IN TRINITY CHURCH.

Francis Lathrop.

fices in order to open a way for artists to express by their art this love and belief.

To turn from theory to reality we find to-day an awakening of Christian Art, a growing interest in ecclesiology, a desire to erect works of beauty in honor of the source of all beauty, and to make plain the same to mankind.

This has been brought about by a revival of faith, a growth of piety, an increase of devotion and inspiration; by the study of mediæval civilization among the learned; and by an earnestness of purpose among the clergy.

Continental Europe, in its recoil from the black night of unbelief, indifference and disorder that wrecked good morals at the end of the last and the beginning of this century, fell back upon the Faith of the past as its only anchor of hope. As the faith revived among the people it called for a material expression of its dogmas and history under forms of beauty, opening once again the fields of religious art to architects, painters and sculptors.

A similar revival of ecclesiastical art took place simultaneously in England; the sources, however, of this renewed life were not the same, they originated in the taste for mediævalism introduced by the writings of Sir Walter Scott, and by the impulse given to Catholic thought in the Established Church through the Oxford Movement of 1832.

Every branch of art found able leaders, men of enthusiasm, rare talents, and great energy: Pugin in England, Cornelius and Overbeck in Germany, Viollet-Le-Duc and Flandrin in France, and Giovanni Dupré in Italy.

These men inspired by Faith, recoiling from the self-seeking of the world, endeavored to rise to the pure regions of Christian Art. Each one, architect, painter and sculptor, entered upon their work with the spirit of faith, love and sacrifice in their hearts, and tried to make their art "a frame for the sacred picture of truth." Amid this revival the branches that developed most rapidly were painting and architecture, and among the handmaidens of the last the glazier's art almost at once took a leading position.

To Germany belongs the honor of re-

viving in our day the making of colored glass windows, although both France and England have a prior claim in so far as having produced the first picture windows subsequently to the French Revolution, but these works were nothing more than isolated efforts of individual artists, while in Germany on the other hand the subject was studied in all seriousness. Artists of ability gave their attention to the matter, and founded a school of glass painters. Munich became the centre of the movement, the worker in glass receiving the support of the then king of Bavaria, a monarch of æsthetical taste and discernment.

Between the years 1809 and 1820 M. Mortelégue painted with enamels on glass a figure of Christ for the Church of S. Roch in Paris; a few years after, William Collins, an Englishman, painted a window representing the marriage of the Blessed Virgin for the Church of S. Etienne du Mont, also three for the Chapel of the Blessed Virgin in the Church of S. Elizabeth at Paris; and somewhere about 1825 two windows were painted in Munich for a church at Ratisbon, after the designs of Von Hess. One was executed by M. Frank, a painter on porcelain, and the other by M. Schwarz, of Nuremberg.

These were the seeds of modern glass work, but for a while they were dormant, not fructifying until after the exhibition in 1831 of the paintings and designs of Frederick Overbeck at the Academy of Fine Arts in Munich. This exhibition gave an impulse throughout Germany to all forms of religious art and ultimately led to the establishment of glass works at Munich, under the patronage of the government. This artistic and ecclesiological movement, inaugurated by Overbeck, was led by Cornelius, an artist of talent, a man of thought, free from limitation and endowed with great energy. "Overbeck was," as King Ludwig said, "the S. John and Cornelius, the S. Paul of the revival."

John Frederick Overbeck, the apostle of Christian Art to the nineteenth century, was born on the 4th of July, 1789, in the city of Lubeck, in Germany. His family for generations were pre-



Duke of Albany's Memorial, St. George's Church, Cannes, France. Heaton, Butler & Bayne.

eminent for learning and for their faithful adherence to the laws of piety as they gathered them from the Bible. The father of the artist was a great lover of the classics and believed in the possibility of harmoniously combining them with Christian thought; he therefore admonished his son to place "Honor in the right chamber of his heart and the Bible in the left." At the same time he pointed out to him that "the artist's and poet's mind should be as a spotless mirror, his heart pure and pious at one with God and all mankind, for the path to the Holy Temple of Art lies apart from the world, and the painter will go on his way all the more unassailed if he stands aloof from the temptation of the senses."

Overbeck left home at the age of seventeen for Vienna, to study under Fuger, then the director of the Academy of Art, a follower of the School of David, and a painter of pseudo-classic inanities. From the first there was very little in common between the pupil and master. Overbeck, following for a time, as he did, the lines laid down by his father, was naturally led to turn his whole attention in loving contemplation upon the art-inspiring pages of Holy Writ, and consequently rejected with scorn the hybrid classicism of the Viennese academicians.

In the fifth year of his studies he quitted Vienna, turned his footsteps toward Italy, hoping to find in the works of the pre-Raphaelite masters safe guides in the realization of his own artistic aspirations. Arriving in



Church Window.

Ed. P. Sperry.



A MEMORIAL WINDOW.

Tiffany Glass and Decorating Company.

Rome he, together with a number of young German art students, formed a colony in the vacant convent of S. Isidoro on the Pincian, a colony of earnest workers, every one striving to realize, not only in their art, but also in their lives, a high ideal. This little band of artists, called in derision Nazarites, whose mission it was to regenerate religious art, were devoted to their ideal and believed that "the true home of art is within the soul before the altar of the Church, and that the tabernacle of art has its foundation in the worship of God." This was the origin of the modern German school of religious art, a school in which the *objective* is almost always sacrificed to the *subjective*, tradition holding a higher place than nature, the artists preferring to copy the works of men, rather than address themselves directly to the work of God; hence their drawing is painfully academic, their technique is hard, flat and devoid of all true feeling for color values, while their composition is too often subordinated to an arrangement that will better inculcate a doctrine or a mental conception than an artistic idea.

The views of the Roman colony were disseminated through the teachings of Cornelius at Munich and Schadow at Dusseldorf. Students flocked to Rome that they might sit at the feet of Overbeck, and imbibe his theory of art and learn his method of work. Joseph Fuhrich became a veritable second Overbeck. Many of these fervent enthusiastic artists returned to the *Fatherland*, where, in frescoed churches and painted windows, they made manifest their master's teachings. The defects of this school are more noticeable in the colored glass windows than in their paintings. The artists seemed to have forgotten that the primary end of a window is to admit light, and that the part it plays in the general ornamentation of the building is only secondary, hence its share in the adornment should be subordinated to its primary use, a truth well understood by the glaziers of the thirteenth century. The chief aim of the artists of the Munich school seems to have been to make their windows frames for transparent pictures,

pictures which expressed theological ideas or historical facts. Color was consequently of little value in their eyes in comparison with form, as form was the true language of such ideas, hence they paid more attention to the drawing than to the color of the glass, using the glass simply as a background on which to paint a picture. This mode of work made their windows unduly prominent, hard, opaque and heavy, and as the glass they used was even in texture, limited, thin and uniform in color, the shadows and lines they produced with enamels were therefore disproportionately preponderant. Then again as they had to use thin and gaudy tints, in order to avoid making the glass opaque, their windows were tissue-papery and valueless as color decorations; moreover as their designs were so purely pictorial and not decorative the artistic effect, when the glass was set in mullioned windows, was greatly marred. That the above objections to the glass work of the Munich School are valid cannot be disapproved and are self-evident to every careful observer, who has studied the windows of the churches in Munich, in the cathedrals of Cologne and Glasgow. Often the designs are beautiful and filled with deep religious feeling, but are far more suitable for wall pictures than windows, and show that an art which is successful on canvas is just the reverse in glass. Or as George Edmund Street said: "That it would have been much more delightful to see such subjects represented on the walls than essayed in windows, where they disobey all the necessities of construction, are deficient in their effect and disagree in toto with all the architecture, the beauty of which they ought to have heightened and brought out." It is evident, the faults of the Munich school are dependent on the artists not fully recognizing that glass painting is a special art, with its own laws, its own powers, its own limits; that the laws of picture painting have no more to do with it than those of sculpture have; that it is light that has to be dealt with, not shadow, translucent glass, not solid canvas; or as an acute observer said: "A picture is one thing, a window is another, and that

which is adapted to have a good effect in one will, for this very reason, have a poor effect in the other. Take merely as an instance the vast difference which lies in the fact that in one case the painter has, as the material on which he is to work, an *opaque* substance, in the other one *through* which the light *freely passes*. In the former case he may manage his light as he chooses and as best suits his subject; not so in the other—he must take the light as nature gives it him and must do the best he can with it. He can resort to no artificial arrangement; if he does he blackens and spoils his windows.”

One of the greatest efforts of the glass painters of the Munich school is undoubtedly to be seen in the Glasgow Cathedral, where they filled forty-two windows, with glass at a cost of one hundred thousand dollars. In this work they were free to display their knowledge and talents as glass painters, except in two particulars: that is, as to the choice of subjects and the traditional treatment of the same. These limitations have been given as an excuse for the inferiority of the windows in comparison with mediæval work, but in truth they were probably more an annoyance to the artists than hindrances in producing good colored windows. That this supposition is correct, the reader will agree with me if he bears in mind that the artists were all fervent Catholics, while the specifications read: “It must not be forgotten that Glasgow Cathedral is a temple dedicated to the religious services of the Established Church of Scotland, which is a Protestant Presbyterian Church. According to the principles and practice of the church, no representations in painting or sculpture are anywhere admitted for religious purposes; the services are very simple; there is no pomp, no symbolism of Rome. You will not use any symbol of the Virgin Mary, of the Holy Trinity, or of any persons of the Godhead; you will place no nimbus or aureole around the heads of any saintly person represented; apostles must not be distinguished by keys, swords, pilgrims’ staves, scallop shells, nor are any to be clothed in the costume of the Roman

hierarchy—angels holding scrolls inscribed with extracts from God’s Word, conveying His gracious promises, may be introduced; but, with this exception, the paintings are to be direct historical representation of a series of scenes from the Bible, treated according to the laws of arrangement and design necessary under the technical conditions of glass painting.” That Mr. Aimmeller and his associate artists may have found it somewhat difficult at times to arrange their subjects so as not to do violence to the prejudices and antipathies of the Scottish Presbyterian mind, I can well believe, but what that has to do with windows as colored glass windows, I fail to see. In surveying the windows of the Glasgow Cathedral, the artistic spectator is at once struck by their thinness of color, by their exaggerated diapered backgrounds, their inharmonious borders of white and red, the general refusal on the part of the colors to blend with one another, and a marked want of unity between the architectural ornaments of the glass and the architecture of the cathedral. The drawing of the figures are excellent, more particularly the Prophets in the North Transept designated by Baron Von Hess, which are strong in conception and expression, but this does not make up for their lack of color value, the first requisite in works of this kind. Through an excessive use of enamel the durability of the glass was greatly lessened, and in consequence many of the windows are to-day disfigured by blotches caused by the peeling off of the enamels.

The day of the Munich school of glass painting has passed away forever; it has reached its limit of development; it has fallen from the hands of artists into that of manufacturers. It was a noble effort, but failed of success because the nature of glass, the requirement of the art, and its place as an adjunct to architecture were imperfectly understood.

The English school of glass painters and glaziers was called into existence and given a strong Gothic bias by the revival of church building and the restoration of churches which had fallen into decay. An activity in ecclesiastical

architecture was brought about, as I have said before, by the growth of Catholic thought within the Anglican church. The effect of the teachings of John Henry Newman and other Oxford men upon ecclesiastical architecture and decorations was magical, societies were formed to study the subject, books issued, papers and magazines founded, in whose pages all points of ecclesiology were discussed and explained. The artist, the architect and the decorator, true to their inborn insular instincts, turned to Mediæval English church architecture for examples to copy, motives to develop, and rules to be guided by.

What Newman was to the new theology, Pugin was to ecclesiastical architecture and decorations, viz.: he was the Father, the Leader, the Lawgiver of the Gothic movement in church building. This singularly gifted man, Augustan Northmore Welby Pugin, a descendant of a family of the Swiss noblesse, the son of an architect, was born in London 1812. He first came into notice in 1836 as the author of a remarkable satire on modern architecture called "Contrasts," which was followed in 1841 by the Gospel of Church building movement: "True principles of Gothic Architecture," and this was supplemented in 1843 by "An Apology for the Revival of Christian Architecture in England." From time to time he put forth other literary productions, all relating to the same subject, among them his "Glossary of Ecclesiastical Ornament and Costumes" is the best known. His drawings are wonderfully beautiful, but his embodiment of them in wood and stone are often disappointing. There may be good reason for this, as he himself said, he never had the opportunity of doing a really fine work, of doing justice to his designs. The college at Maynooth is a case in point. It was agreed to expend £30,000 in carrying out his plans. When the work was under way the sum was reduced to £18,000.

In my judgment, although he was one of the most remarkable architects of his time, he was more of an artist, and, were he living now, he would turn

his attention largely to decoration, as his genius and skill lay in designing ornamental details for the carver, the metal worker, the wall and glass painter. The most important and one of the most successful of Pugin's churches was that of S. Chad at Birmingham, and it is in this church that the student may study the revival of the glazier's art in its first throes for recognition as an important element in the completeness of a fully-developed Gothic church. Here, as in most of the churches of the revival, the true place of glass painting was not understood. Its value as a color decoration was lost sight of. It was nothing more than a slavish imitation of English mediæval glass.

Mr. Warrington, the maker of these windows, although sound in theory, holding, as he did, that "beauty and harmony are founded on propriety," that as a window is a "portion of a building, and, if painted, of its decoration," it should be in harmony with the style of the building; hence if the building be Italian, "so," he says, "in my opinion, should the windows and all other decorations be of a like character." But Mr. Warrington, like all the other glass-painters in England, was at fault when he gave expression to his views in glass, as his were only copies of those of the Middle Ages, he forgot that true art is never mimicry. In place of working out a window on Mediæval lines to something better than was produced in the Middle Ages, he was content if he succeeded in making a faithful copy. Sir Charles Eastlake, in speaking of the windows in S. Chad's, says: "Much of this glass is well designed, so far as the drawing of figures and character of ornament are concerned, but it has the all-important defect which distinguished most of the glass of this period, viz.: a crude and inharmonious association of color." This defect, together with equally as great a one: the absence of color, is now just as common in English windows as it was then, and what is more, they do not seem to be able to overcome it. It is true Mr. Haliday, a follower of Burne-Jones, has attempted in these later days to combine beauty of form



AN ENGLISH WINDOW.

Clayton & Bell.

with beauty of color, but without any marked result. His failure is largely due to the glass he uses: it is too good, too free from blemishes, too regular in tint and texture; then again his color, as well as his good drawing and composition, is often marred by excessive and unnecessary leading. The Englishworkers in glass, as a rule, rest satisfied in being able to make a fair imitation of the windows of the Middle Ages. There is very little progress among them in the way of developing the art or striving after better glass. However, the windows of such artists as Clayton and Bell, and Heaton, Butler and Bayne are creditable as far as they go. They are almost always good in drawing, and much superior in every way to those of any other makers in Europe. If they are lacking in color, they are at least free from the raw and unpleasant contrasts so prevalent in much of the German and French work.

The English artistic world is waking up to the shortcomings of their glass, and plainly see the remedy. John Aldan Heaton, in speaking of the windows in Keble College, and comparing them with those of S. Pierre at Chartres, says: "The mere fact of modern glass being drawn on paper only, even by such accomplished designers as Mr. Burne-Jones, and then transferred to glass by copyists—copyists whom one feels inclined to class as "clerks"—points at once to an inevitable and fatal element of inferiority. What would a man think, having given an order for a picture to an eminent artist, when he discovered that the eminent artist had only drawn it in chalk on paper, and then handed it over to his young man to copy it in color on canvas?"

"Yet this is what is done universally in stained glass; whereby we at once lose 'touch,' sparkle, breadth and originality of handling, and get in exchange the mechanical monotony of the copyist; with this further mischief, that whereas the canvas or the panel may bear, and often with great advantage, the most minute detailing and stippling, as witness the work of Memling or Van Eyck, such work is fatal on glass, where translucency should be a prominent characteristic.

"Indeed, stained glass, theoretically, should be very much of the nature of a *sketch* by an able hand, vigorous in conception, strong in handling of the principal forms, and slight as possible in the mechanism of detail; practically the glass should be *variable in thickness, ribby and full of air bubbles, so as to produce gradation of color and enhance the jewel-like effect of its translucence*—the leads, broad and plentiful, should supply the place of darks—formulae which seems almost exact contradictions of most of our modern productions."

In these remarks Mr. Heaton has pointed out the principal cause of the defects, so noticeable in English windows, and at the same time has touched the keynote which will lead, if followed up, to great improvement in the art. If his suggestions are followed the English glazier will be led to travel the same road so successfully trodden by his American brother.

On the whole I believe I am justified in saying that the larger part of the English windows of to-day are extremely thin, often cold in color, and this in combination with their conventionalism, in spite of their good drawing, makes them rather tame and uninteresting when placed side by side with either Mediæval windows or the rich and deep-toned glass of the American school.

The modern French school of glass-painters is very similar to the German, with even a stronger tendency to look upon colored windows as easel pictures; apparently among the artists there is little or no leaning towards Mediæval processes or any apparent effort to attain in their work the incomparable beauty of the windows which adorned the French cathedrals of the thirteenth and fourteenth centuries.

It is surprising that the glazier's art in France has taken the direction it has, in view of the fact that the glass painter had so many good examples of the old glass at hand to study, and that kindred arts have followed national traditions with the most brilliant results. However it is undeniable that there has been great progress of late, but there never will be any work of artistic value done in glass of equal rank with French



A FRENCH WINDOW.

Designed by Charles Champagneulle.

painting and sculpture until the influence of the German and English schools are cast to the winds and the glass-painter returns to the study of the great picture-windows of his ancestors. Every one knows that the French artistic world is too broad, too progressive to allow its glass painters to walk much longer in the narrow way of the Munich school, and too original to let them be mere copyists of the past like the English. The French call upon all forms of beauty to give expression to their inherent art-sense, while with the Germans art is largely subservient to a theory, a literary idea, and with the English (I am speaking of ecclesiastical art) it is little more than a conscientious imitation of one style—the Gothic period—the dead past.

So far the most creditable colored glass windows produced in France are the works of M. Oudinot, Ed. Didron, Claudius Lavergne, Coffetier and Champeigneulle.

The series of windows made by Didron for a church built at Carthage by the late Cardinal Lavergne are said to have great merit, although archaic in style and composition, and showing a decided bias on the part of the artist toward mediævalism. In contrast of method to these windows there is a rose-window in the Church of La Medline at Rouen, by Lavergne, an artist impatient of all stain-glass traditions, which has been praised by well-known critics for the beauty and knowledge shown by Lavergne in the modeling of the figures, the general composition, the richness of details and ornamentation.

The works of Coffetier are fair imitations of twelfth century glass, but are not so carefully finished and executed as the church windows of Champeigneulle, made on the same lines, and neither artist is equal to Oudinot, whose style is that of the Renaissance. What I have said of French work holds good of the Belgian. All French and Belgian glass painters fall short of their aim, and this is because they all insist upon looking at a window as they would a painting on canvas, but if the day ever comes that they concentrate their minds upon the development of colored

glass windows from a transparent mosaic starting point we will see marvelous results. If the art of glass painting, the making of colored glass and picture windows in the nineteenth century, among the Germans, English and French, has not attained perfection, it is because they have not taken up the mosaic system of the Middle Ages and developed it, a truth proven beyond peradventure by the windows of the American school, where this principle of work has been carried out with great and constantly increasing artistic success.

The American artist in glass is too much of an artist to imitate the works of the past, no matter how beautiful they may be, he sees that to imitate the art work of by-gone days is an open confession of inferiority, and the making a copy do duty for an original is a plagiarism, which is contradictory to the generally accepted principle that the true aim of art is to create and not to imitate, hence, he has endeavored to work on original lines, although he never hesitates to use and develop mediæval motives when they will serve his purpose, yet he is careful to work them out in conformity with the demands of our day, under the guidance of modern culture and the ever-increasing volume of knowledge. He knows that it is impossible to recall the spirit of the dead workman, the spirit of the Middle Ages, the aggregation of influences and forces that brought their work into being; he is essentially a man of to-day, using all the past can teach him in union with all that modern training can give him in skill of hand or modern science in instruments and materials; keeping himself in touch with his age, therefore, we find his work is original, a creation and not an imitation, the embodiment of an artistic thought and not a feeble portrayal of an effete idea of another age.

There is another point, a marked point, of contrast between the American artists in glass and those of Europe, it is this; he seeks for perfect color effects, paying very little attention to form, so long as he reaches his chromatic aim. For this he has been found fault with by some few foreign critics, "men ac-

customed," as a recent writer on the subject says, "to the crude color of Bavarian, Belgian and French modern glass, or to the sad, ineffectual glass of England, and are not capable of understanding our advance." Perfect color with perfect form are seldom found in union even in nature. "Color, to be perfect," says John Ruskin, "must have a soft outline or a simple one; it cannot have a refined one; and you will never produce a good painted window with good figure drawing in it. You will lose perfection of color as you give perfection of line. Try to put in order and form the color of a piece of opal." "Even in figure-painting the greatest colorists have either melted their outlines away, as often Coreggio and Rubens; or purposely made their masses of ungainly shape, as Titian; or placed their brightest hues in costume, where they get quaint patterns, as Veronese." "Any of these men would have looked with infinite disgust upon the leafage and scroll-work which form the ground of color in our modern (English and German) painted windows." The American workers in glass are essentially colorists, moreover masters of their materials, and have at last received a recognition from the most artistic nation in the world; France has conferred upon John La Farge the Cross of the Legion of Honor, for the great results that he has accomplished in glass. Until Mr. Louis G. Tiffany and Mr. John La Farge turned their attention to the study and making of colored glass windows, some ten years ago, Americans were content with imported windows, or with poor imitations of European work made in this country by English and German *artisans*, men of mechanical skill, often of considerable ingenuity, but with little, if any, artistic ability.

The above-named artists began their studies, investigations and experiments almost simultaneously. For a time they worked on identical lines, to at last diverge in their methods, although they both held to the mosaic system, believing it would yield the best results.

Mr. Tiffany aimed particularly to develop the "inherent properties" of the glass to their "fullest extent" in color

and texture, in order to obtain in the glass itself light and shade, through depth and irregularity of color in union with inequality of surface, in that way hoping to avoid the "*dullness and opacity*" which invariably accompany the use of paint.

Mr. La Farge endeavored to obtain the same effects by separating his lights and darks from one another by ideal lead-lines, in some cases plating glass over these lines, seeking to lose the lines or more truly making them apparently a part of the glass, or, in other words, working out his drawing with small pieces of glass, assisted with carefully studied lead-lines, and bringing the whole together, as happily expressed by Mr. Heinigke (who is himself a clever artist in glass), "with a glaze by plating one, two and three thicknesses of larger pieces over them, much as the human skin covers the flesh and blood of the hand."

Either system requires the strictest attention of the artist, not only in drawing the cartoon but in every step taken in the process in making the window; nothing can be left to the mechanic, as the final result depends on the proper adjustment of the color values—the artistic arrangement of the leading—in their relations to the *tout ensemble*. It may be said with truth of both these methods that they are the artistic methods par excellence, "a new style of glass-painting, founded on the most perfect practice of the mosaic system," viz.: the putting together in juxtaposition of various pieces of glass of divers colors and shades, so as to form a translucent picture, where depth of color, light and shade, correctness of drawing, roundness and distinctness are carefully preserved.

Mr. Tiffany and Mr. La Farge have had many followers, but only a very few have obtained marked success; among these Francis Lathrop and Maitland Armstrong stand in the front rank. The reason for the non-success of the many is the want of a true appreciation of color in all its subtle variations and relations.

For the same reason American picture-windows are not appreciated by some foreign observers.

That my readers may understand just how American windows are made, I will attempt to epitomize each step taken in the process of making one, from the inception to the completion.

The artist or designer having chosen his motive (by motive I mean that which actuates or produces a definite conception in the mind of the artist before his thoughts become concrete or tangible), places it upon paper. When making the designs he always keeps in mind "that the function of colored glass is to modify and not to impede the light, and also that, being glass and being colored, transparency and color are its two essential æsthetic characteristics, which must be preserved at any cost;" therefore his scheme of color is studied with great care in its relation to the ever-varying light to be transmitted through the glass, the harmony of color with color, and its psychological influence upon the beholder; whilst his drawing is planned so that his figures profile against the background, as if they were intended for a low-relief; and his leads are so arranged as to assist the drawing, to emphasize the outline, to deepen the shadows, and their use on the other hand avoided where they might diminish the translucent qualities or brilliancy of the glass.

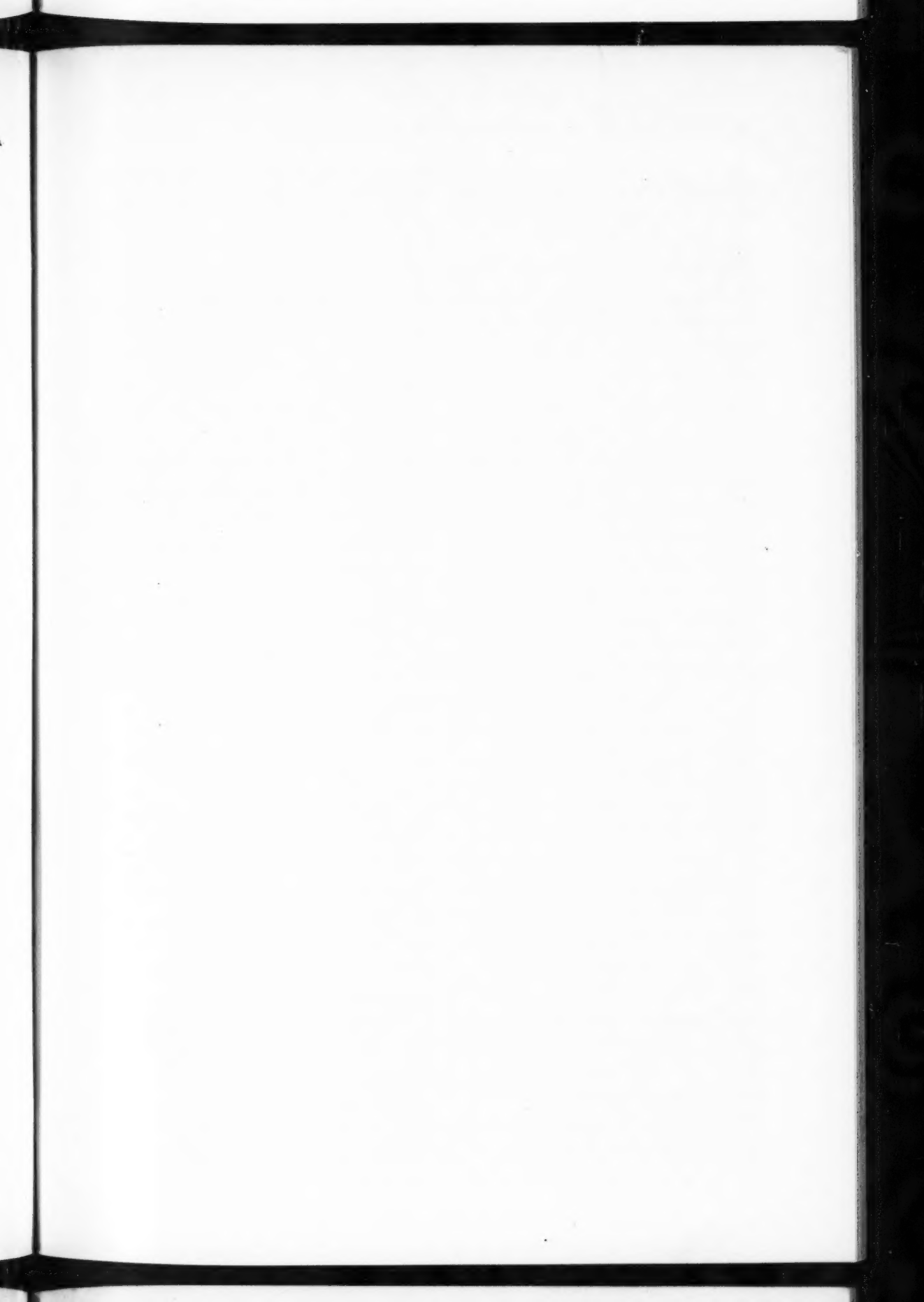
From the finished cartoons two outline transfers are made upon heavy manilla paper. One of these is cut into patterns by means of a three-bladed scissors, which in following the lines of the drawing not only separate piece from piece but removes at the same time a portion of the paper equivalent to the heart of the lead, in this way making an exact pattern. These patterns are placed, in their proper order, upon a sheet of clear glass with bits of soft wax; the space to be finally occupied by leads having previously been indicated with lines of black paint; the whole is then placed against the light. The second transfer is not used until the window is ready to be put together, which will be explained later on.

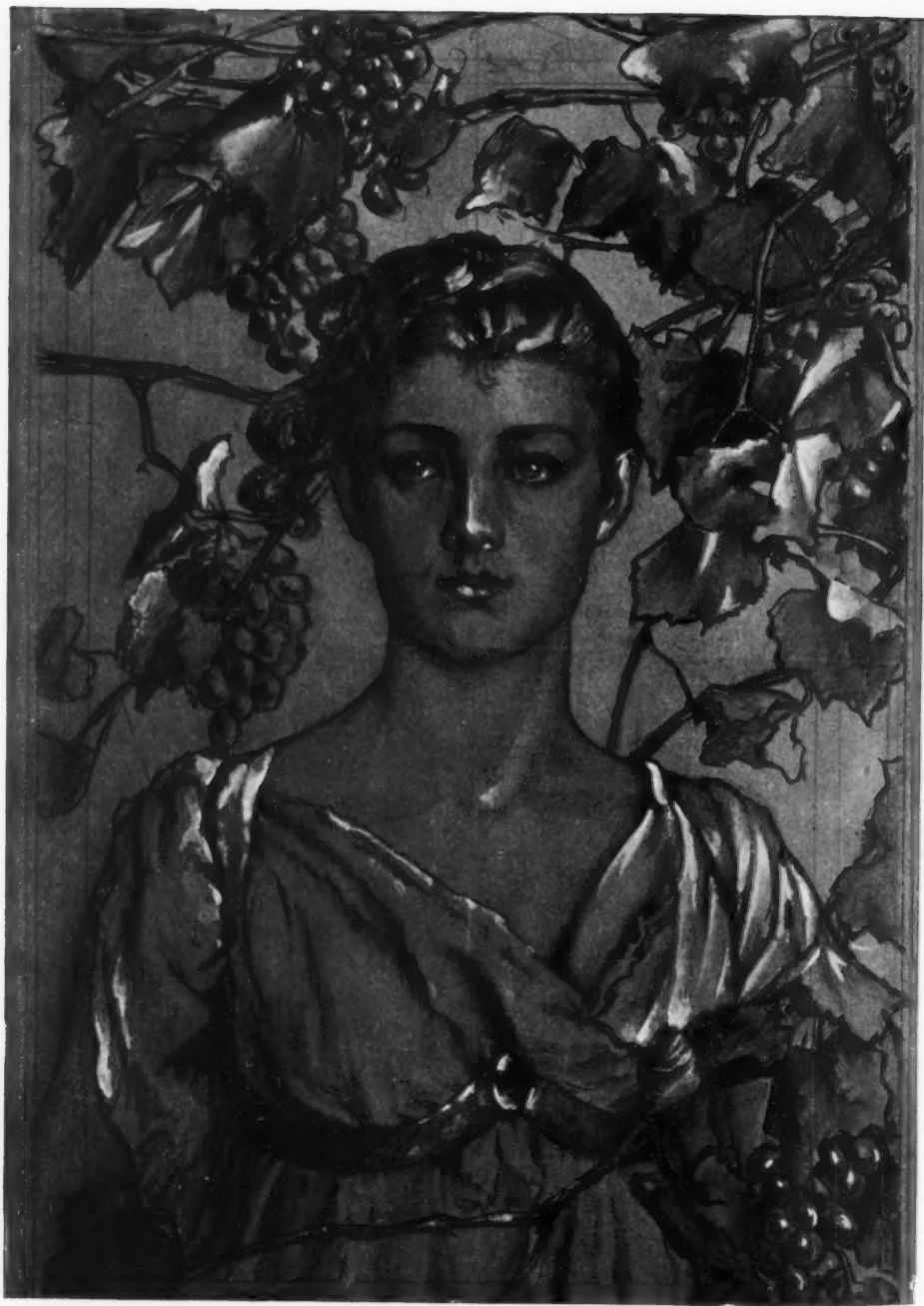
The artist now makes a careful selection of the glass he wishes to use in the window, not only for color, but also for movement, light and shade, or what-

ever may help to carry out his theme both in color and form.

The glazier then, with the artist standing by, with the cartoon and color scheme before him, removes one of the paper templates from the glass easel, and passes a sheet of glass of the approximate color over the opening left, until that part of the sheet is found which corresponds with the color sought. Sometimes a dozen or more sheets pass through the glazier's hands before the right piece is found. When found, the paper pattern is placed upon the glass as a template, and the glass cut to the same shape, which is then attached to glass easel with wax, taking the place of the paper pattern. This process is repeated until the entire window is built up. It often happens the right piece of glass cannot be found, so one piece is taken for the form and this is plated with another for the color, or where the color is not what is wanted, in tone or shade, it is plated with another color, and in some cases more than one plating is used. This method is truly defined as painting with glass, and the beautiful results obtained in its practice fully justify the process. Where the window is to be seen as much by night as by day, the glass is picked for its beauty as a reflecting medium as much as a transmitting one, so as to count both as an opaque and transparent mosaic.

The next step is for the artist to paint the flesh of the figures; this is done with fusible metal oxides, which are made to attach themselves to or become a part of the glass by heat. In this branch of the work very little advance has been made over that of both the old and modern masters, which at its best was and is still unsatisfactory. Here is a great field in which there is much to be done. Americans have heretofore paid too little attention to the matter, although it is one of vital importance, and is many times the rock upon which their work is wrecked. I do not mean to say that our painted work will not compare favorably with that of other nations, but it is not as good as the best work of two or three European masters of the art. This state of things, however, will not last much longer, for the good reason that





THE FALL,
(THE CARTOON.)

Rosina Emmett Sherwood, Designer.



THE FALL.
(THE WINDOW.)

Tiffany Glass & Decorating Co.

a number of artists of ability are studying the subject in a most serious manner. The painted part of an American window will shortly far surpass the work of all other people, just as much as the mosaic portion does now, so that ultimately we will stand, in every respect, pre-eminent in the superlative degree as the makers of colored picture windows.

Our window is now ready for the leads. The glass is removed from the transparent easel and placed in a tray, carried to the work-bench of the glazier, where the second transfer from the cartoon has already been placed flat upon the bench.

A piece of glass is selected from that in the tray, laid in its proper place on the transfer, to form the starting point, to which piece after piece is added, until the whole window is put together, each piece being connected with the next by a narrow line of lead.

The strip of lead used has lateral grooves to receive the edge of the glass, while the anterior and posterior faces are smooth. The metal being soft and flexible, the glazier has no trouble in bending it around the glass, no matter what its contour may be.

Having in this way leaded the first piece of glass, it is held in its place on the bench, over the corresponding lines of the transfer, which is the glazier's guide, by the aid of short, round nails, tapering to a point at one end and square at the other. The next piece is then joined to the first, the edge of the second being inserted in the free groove in the lead, another piece of lead is bent around the second in its turn; in the meanwhile the nails are removed to the outside of the last piece added, and the lead-strip is continued by fitting the end of a new one to the one used. This process is repeated until every piece of glass is fastened to its fellow and the whole window is upon the bench. The joints and pieces of lead are then soldered together on both sides of the window, and at the same time tinned in order to protect them from adverse atmospheric influences.

Where stay-bars are needed the window is fastened, at short intervals, to the same by copper wires, which are sol-

dered to the leads. The bars are so placed as to interfere as little as possible with the drawing or the light and shade of the design; in many cases the bars are made to follow the leading, and often add to the general artistic effect.

In the American school the subject of leads and leading has been studied with great attention, more so than in any other, because the mosaic system requires it in the very nature of things, and consequently there have been vast improvements made, both in the leads and in the methods of using them.

Leads are now made that will bend laterally, but in no other direction, and are used where the window is exposed to strong winds; strong and broad leads are made in forms which give them the appearance of being very much smaller than they are; others are made like hair lines, and yet are strong.

In addition the American worker has invented a number of other mechanical contrivances for fastening the pieces of glass together. The most practicable are those respectively of Mr. Bray and Mr. Belcher. The first is by far the best, because it is freer, more artistic, and can be readily worked in union with every form of leading. With either of these fasteners the finest mosaic can be made, the smallest pieces of glass united one with another in endless combinations.

The mediæval glass-worker was compelled to lead his window to excess, often to the detriment of his design, because he could only make his glass in small sheets; but the modern work does not labor under this disadvantage, although in Europe excessive leading is affected—an affectation born from an unjustifiable imitation of the past. In America, however, as I have said before, every lead line is made to do its duty not only as a fastener but as a line in the composition, sharing largely in the design, helping the shadows and emphasizing the drawing.

The great fault hitherto with American artists in glass has been their disregard of the relationship of their windows to the architectural surroundings; and, again, through their clear knowledge that the true value of glass as a decorative material is dependent upon its

color, the combination of the same, the prismatic play of light, and the niceties in light and shade has made them too often careless in their drawing.

This state of things is rapidly improving; in fact, even now it is a thing of the past, and the future holds out great promises for American glass, American methods and American artists. The prize is ours if we will but take it.

There is very little more to be said about the colored glass windows of today beyond the fact that the *glazier* has

returned—returned to stay; that the Second Spring is here, charged with bright promises for the coming Summer. One more word and I have finished. As the future field for colored glass and picture windows will be largely an ecclesiastical one, it behooves the artist in glass to study the principles that govern Christian Art if he hopes to reach the highest point; and it will also be well for him to remember that the glazier's art is but an auxiliary to architecture, subject to the *imprimatur* of the architect.

Caryl Coleman.



✓ BYZANTINE ARCHITECTURE.

Part V.—BYZANTINE CONSTRUCTION.



WE should think that a contemporary, and probably an eye-witness, of the colossal works of Sta. Sophia would have given us some interesting particulars of the methods employed in building it, of the scaffolding and centering used, and the means of raising the materials, more particularly when there were huge stones to be lifted; but Procopius' eye was single, his sole object was to glorify Justinian, and though we might hope he got his reward, it is to be feared he did not, or he would hardly have published his book of scandalous anecdotes of the Court, and of his first master, Belisarius. As we can get almost nothing from him, we can only hazard a conjecture as to the presence or absence of centering for the original flat dome and for the present one, and all the other particulars we can get are from the existing works. The knowledge that Paul the Silentiary had is put into a poetic form, and this form is not likely to deal with such matters as building, except in so vague a way that it can be but of little use to mere prosaic constructors, and besides its being a poem, it is in Greek. What Salzenberg got to know of the construction of Sta. Sophia is locked up in German, so that anyone treating of Byzantine construction would be either forced to deal in generalities, or to omit everything that could not be gathered from published drawings, or an examination of buildings as they now stand. Fortunately, however, we have a genius amongst us, who, after having laid open to all eyes the economical construction of the Romans, has bestowed his time and talents on making Byzantine construction equally clear. I, of course, mean M. Auguste Choisy, of Paris, the

Engineer-in-Chief of Roads and Bridges. His professional avocations made him anxious to interrogate the past, and to see if the methods formerly employed could not aid him in the present; being a man of genius, he said to himself, Why should I first build a wooden bridge to build a stone one, and then throw the wooden one away? Did the Romans do so? After examining the illustrations of Roman work and pondering on the subject, he sought in the works themselves and in the methods now employed in Italy the answer to his questions, and found the answer to a riddle that had completely posed mankind ever since Roman methods were generally abandoned; for the tile skin of vaults is still practised. Having his observation and his judgment sharpened by his first successful attempt, he sought and solved the more difficult problem of Byzantine construction, and in 1883 he gave to the world his second great work on "The Art of Building among the Byzantines."

It is on this work I must mainly rely for giving you the following descriptions. M. Choisy draws the line of the influence of Roman construction at the Adriatic, and considers that as to the west of it the methods pursued were Roman, so to the east of it all the methods were Greek, modified, of course, by the influences of Asia.

"Persicos odi, puer, apparatus" ("Persia's pomp, my boy, I hate"), tells us that in Horace's time the Romans were not unacquainted with Persian habits, and we may, I think, point to Persian domes as the models from which the Pantheon was imitated, though it is, of course, possible that domes of large dimensions were used at an early period in Asia Minor, which successive invasions may have destroyed, not to speak of the destruction

wrought by the savage Tamerlane and his Tartar hordes. The emperors of the lower Empire were constantly at war with the Persians for the possession of Mesopotamia and Armenia, and the Byzantines must consequently have been even more familiar with Persian methods than the Romans. M. Choisy came to the conclusion that as the Romans had found a cheap method of vaulting by first covering a light centre with a network of brick, and then filling this with horizontal rubble work, so the Byzantines had turned their vaults without any centering at all. He says:—"Analyse a Roman vault of Western construction, you will scarcely find in it anything but a little framework of brick, which is its bony structure, its skeleton; the rest is only a structureless backing, a filling of pebbles and of mortar, a concretion pure and simple; one of those wisely primitive works from which intelligent labor is purposely excluded, and which shows an immense material force, the passive instrument of a powerful will. In the East, on the contrary, in the Grecian countries, all is combination, all is calculation; each fragment has its office, and its appointed place, in the vault of which it makes a part; besides the ruling idea which conceives, the adjusting force which executes, is seen throughout: one feels transported into an entirely different surrounding; and the monuments of the two schools thus betray, even to their smallest details, the difference of the hands they have come from. I try to see a point of contact, a community of thought and of tendency, between these two schools, and the only common tendency that I can seize on is this: on either side they wished to be freed from the subjection of helping works and of temporary aids. Is this a result of imitation, or the effect of traditional influence in the two schools? For my part, I incline to see in this search for economy one of those chance meetings which good practical sense would bring about without any exchange of ideas. Whichever it may be, the analogy is only found in the principle; directly one comes to the details of applying it the differences reappear, and the two schools separate from one another.

At Rome, where the vault is a monolith made from a plastic material, the solid mass which forms it requires a mould, and the Roman architect gives in effect to each vault its centering. But he is loath to build this centering merely to destroy it afterwards; and with this thought he applies a mixed construction, half brick and half timber. The vault is finished, the timber part alone disappears; all the brick work remains embedded in the mass, and associates itself with its resistance; to embody in the vault the greater part of the mould which has carried it, is, in short, the Western method. Amongst the Easterns the notion of saving takes a more positive form; the question for them is not to lessen the expense of the helping works, but to omit them. The Greek architects frankly proposed to themselves the problem of vaulting without centering, and, thanks to the ingenious disposition of the materials, they were enabled to solve it. They raised the greater part of their vaults by building them in the air, without support, without a resting-place of any kind; their method is not a variation of that of the West—it is a system altogether different, and one not even derived from any Roman source. (A. Choisy, "*L'Art de Bâtir Chez les Byzantines*," Introduction, 4to. Paris, 1883.)

Having now explained the ruling idea, I will treat of each particular part of the structure.

Byzantine walls mostly have the stones of the rubble larger than in Roman work, and this rubble work was never rammed. Instead of the one course of bricks about every 5 feet, they used from three to five courses of brick about every 10 feet in height, and in fortification about every 5 feet. Byzantine bricks are said to be generally larger and better burnt than the Roman ones, and the mortar-joint is rarely less in thickness than the brick and often thicker. At Blachernæ the mortar is about two-thirds of the whole material. To make this mortar properly resistant, broken tiles that would pass through a 9-16 inch mesh were mixed in it. This mortar is called by Vitruvius *Opus signinum*, and

was used as a hydraulic cement and partly as a material to resist heat. It is still used throughout Macedonia and is now called "Khorassan" work. The Byzantines preferred their lime made from marble, but used limestone when marble was difficult to get or too expensive to use, and, from the present Eastern practice of keeping slaked lime for years in huge pits, it seems probable that it is a continuance of the old Roman custom.

As I mentioned in speaking of the churches at Athens, the walls faced with stone have generally one or more courses of brick between the stone courses, with very thick mortar-joints; this gave more soft matter to squeeze than if the stone facing had been laid with thin joints, and there was consequently less danger of separation between the facing and the rubble backing; the bricks, too, generally project beyond the stone, and act as bonders to the rubble. Byzantine columns were marble monoliths, mostly used against the beds, with square, squat caps, beveled off at the bottom into the circle. If the pier supported was a parallelogram, the thick abacus was generally a separate stone, and was but slightly beveled at the sides and deeply at the ends. Bronze rings, sometimes with fringes, are frequently added above the base and below the necking of columns, to prevent scaling or splitting; many cases of their use may be seen in Sta. Sophia. When columns were required of such a height as to render the use of monoliths impossible, as in the case of the cistern of Philoxenus, there was a circular piece of stone or marble *on its bed*, much larger in diameter than the columns, between each shaft, on which the upper column stood, while the lower one was sunk into it; this acted as a restraining ring—at any rate, to the lower shafts. Both metal and marble rings are found at the junctions of the slender shafts surrounding piers in Gothic work. Sheet-lead was inserted by the Byzantines between the junctions of columns with their caps and bases.

There is no time in a lecture to give every example of the ingenuity displayed in economizing centering, when

centering had to be used; but, I may say roughly, that it was done, in the case of stone vaults, by building them in unbonded sections, so that the set of centres used for the first section could be used for each succeeding one. We shall see hereafter that this principle of unbonded sections was carried out in brick vaults where no centering was used. The baths of Diana, at Nîmes, which is Roman work, is vaulted by means of ribs and panels; the stones forming the panels are laid into the rabbets of the ribs, and require no centering. The temple of Diana, close by, is vaulted in much the same way, so that one rib centre is all that is required for the whole building. Arches are often made by using square voussoirs, with the taper in the mortar-joint; and as often as not, they are built with a course or two of brick between the stone cubes.

We, who build brick barrel vaults on centering, make each course parallel with the side walls, and each brick, being placed on the centering, naturally falls into a normal to the curve; if we were to try and build such vaults without a centre, when we got up to the angle of slipping; we should be at a loss to know what to do, unless the cement were strong and quick-setting, and the springing were sufficiently thick or tied down, to prevent the sides from toppling over.

The Byzantines hit on a novel expedient; they built their vaults in slices the other way, *i. e.*, they stuck the bricks against the heading wall or arch, where they were kept by the adhesion of the mortar, till the arch was keyed, and then another slice or arch could be built against the first; there being no bond, the mortar alone secured the adhesion of each ring to the next. There was, however, the same difficulty that there is in standing up books vertically, the least touch will upset them, and we therefore put them at an angle, with the top touching the wall. The Byzantines built out a skewback on the heading wall or vault, so that besides the adhesion of the mortar the position made the bricks less liable to fall, only from the bricks being laid sloping, the soffit of the arch was not flat, but like

the teeth of a saw ; this, however, made a better key for plastering or mosaic.

The Byzantines eventually brought out the ends of the springing so as to form a curve on plan. This scheme seems to have been adopted in the aisles of Sta. Sophia at Salonica. Sometimes this scheme was only partially used ; the springing courses were built in the ordinary way, parallel to the side-walls, up to the slipping-point, and the remainder was then vaulted over in sections at right angles as before. At Hadrian's aqueduct at Constantinople a brick vault has been built up to support the stone one that was giving way, and the builders managed to keep up the springing, until the two sides were within the length of a brick apart (some 2 feet, I should guess), and they then wedged bricks in at right-angles.

If a barrel vault was built from one end only, when the work got nearly to the other end, they wedged in bricks at right-angles to the face of the rings ; when it was begun at both ends, the middle was filled in by putting alternate slices against the springing and against the arches, so that the ends of each course were abutted, as may be seen in the vaults of the cistern of Philoxenus, or by making these in sections of several courses, until the centre could be filled in with the length of one brick. Another plan adopted was to build the end of the vault on a rough sort of skeleton centre of bricks, leaving a toothing inside, and continuing the vault by means of toothings ; this method was mostly employed when rough stones were used, which could not, like bricks, be held up by the mortar only, but could be secured by it when one end was wedged into the toothings. In an ordinary groined barrel vault on a square plan, the sections through the crown on both axes are straight lines. The Byzantines not only thought that the crowns of vaults so built were too weak, but the ellipse formed by the groin points gave them too much trouble, as it did the early Gothic builders. Consequently they made the groin point a segment of any height less than a semi-circle, and made each

panel of the vault of the same section by letting the section revolve on the central axis. A vault of this sort has a peculiar appearance, and if horizontal sections through it are made, they take the form of quatrefoils, and if a vertical section is made through the crown, the ends of the curve are rounded upwards. This peculiarity may be seen in the aisle vaults of Sta. Sophia. Out of stone countries domes were mostly built of brick, and the plane of the rings was not normal to the curve, but flatter. These planes, if produced, formed an inverted cone, whose apex was much above the centre of the dome, and the cone was made flatter as it approached the crown. In a few examples, when the dome had been raised to the slipping-point, it was carried on by nearly parallel rings, so that above the slipping-point it was almost a pure cone made by the revolution of a triangle. This may be called the Arab fashion, as it was a form of dome greatly favored by them. In some cases the top of the dome was made on a platform and put on in a single block. M. Choisy says he saw this being done in a Greek workshop at Smyrna, to finish a dome built without a centre ; the tops of domes were sometimes formed into little domes of sharper pitch.

Domes up to a certain period—M. Choisy says to the ninth century—were made with an abutment at the bottom, carried up vertically, and then joined to the segmental cap by a concave curve, as at Sta. Sophia, the windows being formed in the vertical part. It was the custom, up to a certain epoch, to stiffen the shell of the dome by internal ribs, as at Sta. Sophia, in which there are forty ribs, with forty gussets between them. In later work ribs are often used as an ornament, and are then, I believe, merely bricks stuck on ; but at Sta. Sophia the ribs are bonded into the shell. There is another form of dome of very striking appearance, *i. e.*, those that are fluted, as that at St. Sergius and Bacchus. These are so common in later examples as to be rather the rule than the exception. This form admits of a circular dome being placed on an octagon, the points of the octagon coming in the

centres of the flutes. The points of the flutes act, like ribs, as stiffeners.

Another method of construction for domes which preceded Byzantine times, is found in the temple at Diocletian's Palace at Spalato, called by Adam the Temple of Jupiter, and shown at plates 33 and 34.* This method consisted of turning arches, and filling in between the spandrels with smaller ones, then turning arches from centre to centre on the extrados of the arches in the spandrels. M. Choisy believes that domes of this sort may be built without centering up to the slipping point. This method is correctly shown in "L'art de bâtir chez les Byzantines," woodcut 76, p. 69, and in the plate No. 14, M. Choisy having found Adam's plates incorrect. Adam being a gentleman and not a bricklayer, never seems to have asked himself why it was done, although he drew the dome partly covered with plaster, which proves that it was a constructive and not an ornamental expedient. There is, however, a semi-dome to the vestibule of the tomb of St. Demetrius at Salonica, which, from being set out in a pattern and having ornamental bands in the arches, was evidently made to be seen. I made a rough sketch of it under difficulties. I had no candle, and could only sketch by looking at the place, and then putting it down on the other side by the light of a little window, and I was too lame with sciatica to mount a ladder and measure it, even if I could have got a ladder. I mention this so that some of my hearers who visit Spalato and Salonica may carefully measure both.

Every architect knows that the dome of San Vitale is constructed of hollow pots, the pointed end of one, put into the open end of the other, spigot and faucet fashion, a double line of these was carried round in a spiral, and made the whole construction light from the centre being hollow and without thrust. The father of the late Professor Cockrell used pots like these for the filling in of the spandrels of a vault he built in the Cutler street warehouses for the

East India Company. This construction of mortar, with a core of hollow pottery, was used for the vaults of the Chapel of St. Satyrus at Milan, and at the Baptistery at Ravenna, both of the fifth century. M. Choisy says this construction is still used in Syria, Jerusalem and Jaffa, only there they are used to form voussoirs; the terraces over cupolas were also made of pots, this construction he found at *Μονή τῆς χάρας*. There was also another plan used: the ordinary segmental roofing tiles were laid as voussoirs, with the hollow part upwards, and over the joints others were laid the reverse way, making a chain bond of every course; this is found at the buildings of Mt. Athos.

For forming niche heads in brickwork, two or more courses were adopted:—1st, the outer arch rose from a flat skewback, and the joints, though slightly convergent, did not converge to the centre; 2nd, the lower part of the niche was carried up horizontally to the slipping point, and above the courses were convergent as before. When, however, the niches were flat, they often made the joints converge to a central vertical line. This form is called by the French "The fern-leaf pattern."

The first attempts at doming over spaces that were not circular were made by converting a square into an octagon where the pendentives are small and corbelling may be used, but an octagon was found to be almost as inconvenient as a circle, and circular domes were turned over squares by means of squinches. At St. Nicodemus and Daphne, at Athens, and in the west at Sta. Fosca, and in the domes of Parma and Piacenza instead of squinches we find conchs or shells. The various ways in which squinches and conchs are constructed are endless. The first dome with pendentives on a square plan, known to M. Choisy, is at Djerrach, and in this case the pendentives and the dome itself are struck from the same centre, and the joints of the pendentives are normal to the curve; the ends of the pendentives merely abut against the arches, but where the dome proper, in stone domes, springs at the level of the crown of the pendentives,

* "Ruins of the Palace of the Emperor Diocletian at Spalato." By R. Adam. 1764.

it abuts on a skewback worked on a course of stone over the arch. There is another case with a much flatter dome, at the Mosque of El-Aksa at Jerusalem, supposed to be of the age of Justinian; both of these have this peculiarity, that the upper courses of the pendentives are thicker in the middle than at the ends, made so by means of a convex curve at top, and the joints are without mortar and beautifully worked. M. Choisy says that brick domes on pendentives of Roman times are found in the valleys of the Mæander and the Hermus, but that the practice only became common in Byzantine days. These domes were of two sorts, those in which the dome and pendentives were struck from the same centre, and those in which the pendentives and cupola were of a different radius; a course of bricks was originally laid over the arches and chamfered to make a skewback against which the curve of the pendentive abutted, and the pendentive was backed up so as to form a square outside, consequently the dome had the appearance of rising from a square. For the sake of economy this brick skewback was often left out, but it was found that the acute angle formed by the abutment of the pendentive against the arches was too weak, and they then abutted the pendentives at right angles to the arches, either by a two-centered arch or by the arc of a circle, which prevented the pendentives being the arcs of the great circle, and as the dome took the form of the top of the pendentives, the domes were either squares with quadrant angles, or like an orange squeezed in on four sides; these domes may be seen at St. Marks and at Sta. Sophia, at Salonica.

These deformed shapes had, however, this advantage, that they could be used for oblong spaces; he observes, too, that when the cupola was of a smaller radius than the pendentives the Byzantines used thin bricks for them, not thicker than a roofing tile. The Byzantines gradually got to make these pendentives and domes as flat as was convenient, being only restrained by the impossibility of abutting the horizontal thrust when they were too flat.

It was not until the sixth century that domes were used of smaller radius than their pendentives, Sta. Sophia being one of the first known examples. M. Choisy also believes that it was not until the Macedonian dynasty, from the ninth to the tenth century, that drums began to be used and that St. Bardias is one of the earliest examples (1028 A. D.).* In the decadence of the Byzantine Empire pendentives became pure corbelling, which enabled the Byzantine architects, when working for the Turks, to cut them into fancy shapes.

To revert to the groined vault, no matter whether the plan was square or oblong, if the line of the groin point became a semi-circle and the vault was generated on this, it became a dome, the pendentives being an integral portion of it. These domes could be worked in slices just as the groined vaults were.

In almost every Byzantine church you see wooden ties that are carved in the fine ones and are plain in the ordinary ones. M. Choisy, who has visited a good part of Asia and Africa, recognizes in these ties a triple duty. First, they acted as bond to prevent unequal settlement while the work was being carried on; secondly, as ties or struts, to prevent the deformation of arches, vaults and domes while the work was green; thirdly, as safeguards against the shocks of earthquakes to which Asia Minor is so subject. The Byzantines did not trust to these ties, as all the thrusts were amply abutted—they were only an additional precaution in case of earthquakes.

Probably the architectural students remember that the Temple of Diana at Ephesus was built on a marsh to minimise this risk and that the foundations were laid on a bed of sheepskins and charcoal, the remains of which were found by the late Mr. Wood. Constantinople was equally liable to this terri-

* On the architrave of the door is a Greek inscription stating that the church was built by Christopher Bardias his wife and family, in honor of the Virgin, with the date of the 12th indiction, 6537. This inscription is given by Texier and Pullan in their *Byzantine Architecture*, 1864, and by Duchêne and Bayet. "*Mémoire sur une Mission au Mont Athos*," (8vo. Paris, 1876.) And, curiously enough, they both agree in the date, though not in the translation. The era of Constantinople was 5508 or 5509, giving 1028 or 1029. From the acknowledged inaccuracy of Texier and Pullan, I have taken Duchêne and Bayet.

ble affliction; it is stated that a series of shocks took place for eleven consecutive months. The original dome of Sta. Sophia was so shaken that parts of it fell on two occasions, and Antioch, Berytus and Nicomedia were destroyed by earthquakes during Justinian's reign. M. Choisy tells us that he visited Echeqli a few months after an earthquake, and found to his astonishment that the mosques with domes were standing almost untouched in the midst of the ruins of the town. Vitruvius (Lib. 1, cap. 5, par. 3) tells us, that walls of cities should have their faces tied together frequently with charred olivewood. At St. Demetrius, at Salonica, a continuous band of planks was run through the arcades on the top of the caps of the columns. In the case of barrel vaults, there were two longitudinal plates on each side wall at about the slipping-point, with crossties halved on them; in groined vaults the plates and ties form a rectangle passing through the centres of the piers, and in domes four angleties go across as well. In the cistern of the thousand and one columns, there are holes at the top of the caps, on the four faces, where ties, in round or half-round timber, tied them to the other caps. All of us have seen the iron bars that run across the arcades of Westminster Abbey; and in certain cases the Byzantines used iron ties, as at Sta. Sophia, and in cases where an iron trellis was used, as the bond for piers, the ends of the bars were not let in, and run with lead, but were caulked up and down so as not to split the stone.

It should be remarked that the conception of abutments by the Byzantines was diametrically opposed to that of the Westerns; the Westerns put their abutments outside, the Byzantines inside. The only exceptions I recollect are in the case of San Vitale at Ravenna, and the church of Dighour in Armenia. Even as regards the sets-off to walls, the Byzantines usually make them inside. By the Byzantine method more ground space was got, with very little extra expense; but to our eyes the fact of the buildings being vaulted is not expressed, and those who like buildings cut up

into slices complain of the want of light and shade.

The difference of thrust between groined vaults and domed structures is this: In groined vaults it is a direct outward diagonal thrust in the direction of the groin points, while in the dome it is a diffused thrust all round the periphery, and the aim of the Byzantine architects was to counteract this diffused thrust by other vaulted structures; so we see that, as a rule, the thrust of a central dome is abutted by wide barrel vaults on the four sides.

Another method was to abut a dome on pendentives, by four flat apses with domical heads. Sometimes a mixture of both is used; two sides are abutted by half domes, and two by barrel vaults. At the Church of Sti. Apostoli at Athens, apparently once a baptistery, the thrusts of the four barrel vaults are abutted by triangular domes behind the columns, and by the heads of the niches. The plan of this church is set out geometrically; from the centre of the central dome a circle is struck; where the north and south and east and west diameters cut this circle are the centres of the apses; where the diagonals cut it are the centres of the niches. Sta. Sophia is the mixed case before mentioned, where two sides are abutted by apses, and two by barrel vaults.

The central dome and its pendentives are abutted east and west by hemicycles, and north and south by comparatively narrow arches; the hemicycles give abundant abutments, but the arches are of themselves insufficient, consequently the architect has carried two enormous piers on each side, from the nave to the external wall: the piers are hollow, and offer two spurs of irregular thickness—those opposite the east and west arches of the nave being thicker, while the thinner spurs abut the pendentives.

In arranging the aisles, the point aimed at was to get the east and west arches of the dome to spring as low as possible, so as to get the upper gallery of the aisles as an abutment. The dome, which was originally too flat and not sufficiently abutted, fell, and had to be replaced with one of less thrust—*i. e.*,

of greater height ; after this, a sinking in certain places occurred, the ground on which the four piers of the dome stood compressed more than the other foundations, the vaults between the inner and the outer main piers were forced out of shape, and had to be kept up by arches added underneath, supported on those piers before mentioned that are nearly 6 ft. square, and which choke the circulation in the aisles ; the pavement of the upper galleries slopes inwards to an extent that is visible, and these settlements happened within half a century of the building of Sta. Sophia ; the pendentives are now surrounded with large masses of material which had to be built round them to prevent the building going to ruin ; but in spite of the original fault of construction, the church has lasted more than 1,300 years, and is one of the most magnificent creations of architecture. Its conception was too original to be perfectly carried out at the first attempt, but subsequent Byzantine architects continuously strove to avoid its defects, while following it as their model, and the best way to find out where it was weak is to compare it with the subsequent churches for which it has acted as a model. At Sta. Sophia, at Salonica, the arcades, north and south, were set back 11 ft. 4 in. from the face of the piers, and these barrel vaults have been found sufficient for the purpose, without requiring any other abutments, only in this case the dome is 33 ft. 6 in. diameter, and that of Sta. Sophia 103 ft. When the Byzantine architects had to work for their Turkish masters, they ultimately abutted the north and south sides as well by hemicycles, as at the mosque of Achmet. At the mosque of Adrianople,

built for Selim II. (1566-74), the architect got eight points of support instead of four, omitted the grand hemicycles, abutting the skew sides of the octagon and the kibla by apses, three of the straight sides by buttresses, containing staircases, and the fourth side by the walls of the recess of the kibla.

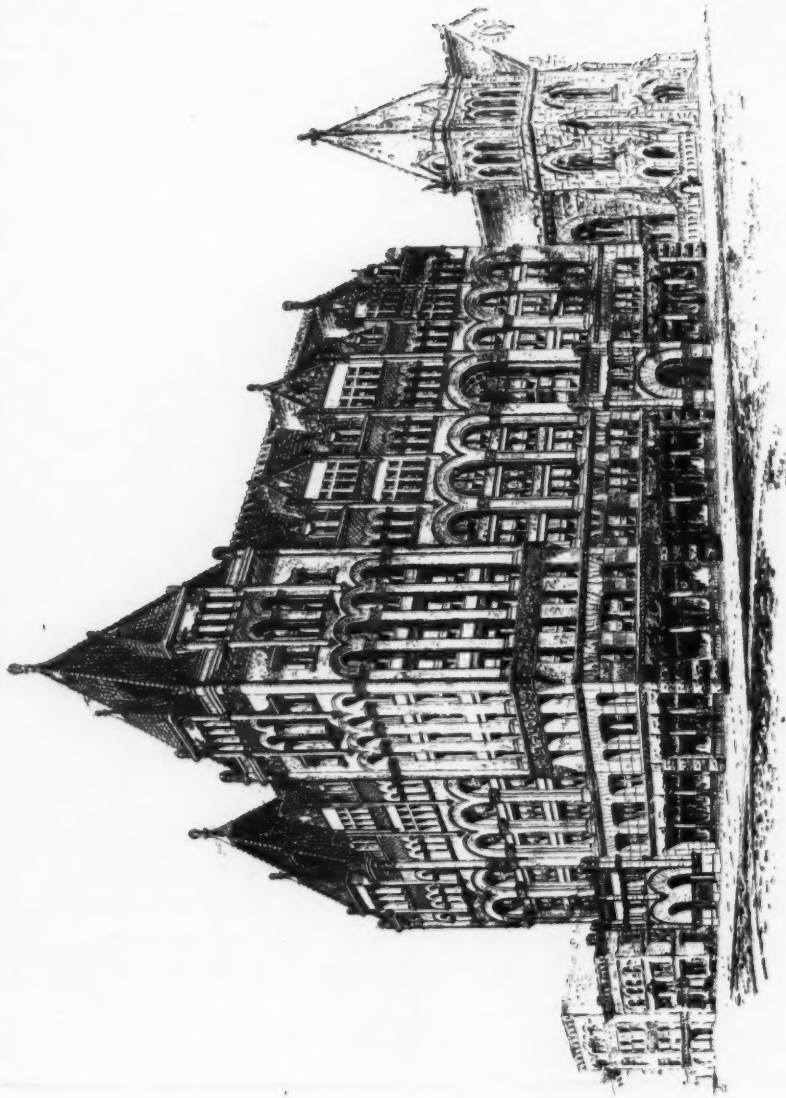
To me the constructive improvements introduced by the Byzantines form a most fascinating study, as one can follow each improvement, from the simple wall to the abutments of vast domes, and can see the persistent efforts made to cure defects and to get over the difficulties that arose in practice, while in addition to this, one sees that the eccentric shapes that vaults and domes often took are purely the result of the unimpeachable logic of construction. I think we in England have hardly shown a due sense of the gratitude we owe to M. Choisy, a government engineer overwhelmed with work, who has devoted his holidays and the small leisure he can find to the elucidation of methods of construction that, before his publications, were absolutely incomprehensible—who has followed up the subject with the sagacity and perseverance of a sleuth-hound ; who has visited Italy, Dalmatia, Greece, Macedonia, Thrace, Asia Minor, Syria, and North Africa to ascertain the different methods of Byzantine construction, and to make sure of his conclusions ; no ruins and no alterations that were being made have escaped his vigilant eye, and he has observed all the current methods of construction to see if any of the ancient practices are still preserved. I trust you will signify by your applause the benefits he has bestowed on us and on the world.

Professor Aitchison.

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PERSPECTIVE
 of design for
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 CINCINNATI, OHIO.

Submitted by
S. M. HOLDEN, Architect

RAYMOND LEE.

CHAPTER XIII.

RAYMOND'S ERROR.

THE "law of required change" is very active in natures like our friend Winter's. Ralph lived chiefly at the periphery of his experiences, where unrest is strongest and the tyranny of the mood or moment fiercest. He had been led to accept a position in Marian's schools by a restless desire for his own approval. The theatrical element in his composition kept him for ever playing to his own shadow. When he decided to remain in Eastchester and immerse himself in the prosyness of Smeltham for the benefit of orphan and pauper children, he felt that at last he was clothing his spiritual life with tolerable completeness. He enjoyed something like the sensations that tickle the parvenu upon first infringing upon "Society;" only in Ralph's case the elevation was a moral one. Yes, here too in the moral world as well as in the world of dollars and cents, peerages and distinctions, there is something, difficult to name, that is akin to snobbery. We find the *nouveaux riches* who have recently "struck oil," deep veins of unctious religiosity, and chapmen and commoners whose nobility in virtue has been "conferred," not inherited as a natural endowment. The tailor-made gentleman in Society has his counterpart among the morally elect. Perhaps we ought not to blame Ralph if he mistook an easy self-satisfaction for spiritual exaltation. Who hasn't done so, particularly in these days when we are so busy forming co-operative societies for our moral gratifications in order that we may eke out a sensible result from exceedingly small personal con-

tributions? Tallowfat belongs to the Haut Ton Charity Organization, and once a year, when he makes his limited donation (as published in the Society's report), the good man feels that he has been repeating the miracle of the loaves and fishes. Last year each member of the Society of Virtuous Spinsters must have obtained almost the delights of industrious maternity through the reclamation of the thirty-six fallen creatures reported by the Society's agents. In this age of wonderful economies is there anything more admirable than our labor-saving devices?

After a short time Ralph again grew tired of himself, even in his moral rôle. The trouble was he couldn't perceive that the ideal is only our every-day commonplaces viewed in a certain perspective. He was incapable of understanding that the commonplace is the substance and centre in which the ideal inheres. There are no heroic moments for the hero. Surely one of the dull-est, painfulest drudgeries that man can possibly perform is the making of grand history. Ralph detested the commonplace; he was impatient of drudgery and was convinced that either precluded the ideal. A couple of months at Smeltham disillusioned him. The monotonous surroundings at the school-house lost theatrical value as scenery, and vulgar children striving with the alphabet turned out to be a most insufficient chorus for a hero. He settled down, though with only sub-conscious purpose, to the part he had really been playing from the first in the Smeltham experiment—that of Hero to the Heroine.

Daily intercourse with Marian gave Ralph the fullest opportunity for his part. The little nun was very pleased when Ralph offered her his assistance at the schools.

"Can you find room for me, Miss Pilgrim?" he asked, in a tone of penitential supplication. "I have come to the conclusion that all that you have said to me is right; my life has been too much an affair of self, and of late" (Ralph spoke with feeling), "old voices that I haven't heard for years have been audible."

Marian was delighted. The instinct in woman to save man was gratified. Besides, in the confession of the proselyte is there not a note of laudation for the Evangelist? Mar-

ian's ear was not sensitive enough to recognize the strains of a prothalamium as the undertone of Ralph's confession.

Consciousness is aware of but a small part of the motives that induce us to act, and, dear reader, it was imperception not hypocrisy, or purposeful double-dealing that was at the bottom of Ralph's decision. At first Winter seriously adopted his new life. He deluded himself with the utmost elaboration. He changed his room at the Carroll's because there was a bare possibility that it might be needed by the organist by and by, and Ralph desired to be permanently settled. He purchased a piano and a miscellany of standard works for "study." He wrote home, settled certain financial affairs and—opened a diary in order to record his experiences. The first entry begins: "This new life of mine must not be a failure. Please God it shall not be. My hand is to the plough." An entire page of self-expostulation, self-urging, self-assuring follows, ending with: "Have just been playing Beethoven. Lost myself in dream; and the music, as though it were Marian's spirit, took form, and my love was beside me singing to the cadence of the notes. I write 'my love,' but will you ever be mine? I feel sometimes that, like Dante with Beatrice, I love a spirit, not a human being. There is, despite the immediacy of touch and sight in our daily intercourse, a sense of—what shall I say?—remoteness, that tantalizes me always and chills at times."

Day after day Ralph set out for Smeltham, sometimes alone, but not infrequently in company with Marian, either driving or afoot. This companionship was charming. It was so near, so exclusive of interference, so unconstrained. Surely, it would have flattered the hopes of any lover. But, Ralph soon discovered that it had limits, or rather limitations. Strive as he might, he could not extend his friendship with Marian beyond the point already attained. He found that as he pressed away from the centre of the peculiar set of circumstances that had brought them together he seemed to remove himself from recognition. It was as though he were associated with somebody whose familiarity with his language was sufficient for the inter-

change only of a very limited number of well-defined ideas. For complete intercourse another tongue, unknown to him, was needed. Ralph believed that he would be able to discover even that in time.

Ralph's progression along the course he had entered would have been more rapid than it was but for his meeting with Raymond Lee. This new friendship caused him to linger on his way. It added so much to his existence at one point that he did not mark how much was subtracted daily at another. He did not notice as acutely as he might how the Smeltham schools, the Workingmen's Club, the boisterous, unkempt children—the material of his new spiritual life—slipped little by little into the drab of the commonplace, and how rapidly the fire of his new emotion was burning out before any part of this material had been permanently stamped with the character of the ideal. Ralph's enthusiasms were of the kind that need to be centred in flesh and blood. A personality rather than an abstraction was always the centre of his adoration. It had been so with Marian and the schools; and with Raymond Lee, he won Ralph's love—for the friendship was not less than love—because in the essence of Raymond's nature, in the fabric of the younger man's personality, there were certain spiritual elements which Ralph longed to possess in himself, yet felt were hopelessly beyond his attainment. He was dimly aware of the contents of his own character, and perceived still more dimly that our natures are the product of an alchemy beyond the scope of human power. We may develop what there is within us, but we can impose little from without. There is no alembic wherein the grosser elements of our nature can be transmuted and the dross converted to gold. We cannot create a virtue we do not possess any easier than we can supply a deficient sense. The poetic sensitiveness, the natural truthfulness, the dominant quality of inevitableness in Raymond's individuality attracted, fascinated Ralph—the new friendship was an addition to his own life on the side of its deficiencies. So Ralph clung to him as a part of his salvation; and, as friendship with Ralph was a very active affection, not only begetting at every little

turn of companionship ardent, spontaneous generousities, but necessitating confessions and confidences, it was not long before Raymond—despite protests and his natural distaste for obligation—found himself a deep debtor to Ralph for scores of delicate kindnesses, as well as the keeper of all his intimate confidences. Painful as the position was, Ralph forced him into the full possession of all his hopes concerning Marian. He came in time even to look to Raymond for comfort and advice.

One Sunday morning the two were seated in Ralph's room at the Carroll's. Raymond, of late, had made it almost a regular practice to remain over Saturday night with Ralph.

"For Heaven's sake, Raymond," cried Ralph, irritably, "throw that 'butt' away and light another cigar. Help yourself. Beyond a certain point economy ceases to be a virtue. Light it well. If it doesn't burn evenly it will be no better than the offence it displaced. Pshaw, doesn't it rain!"

Ralph arose and went to the window overlooking the garden and the Cathedral beyond it.

"I like to hear that soft, steady downpour," said Raymond, lazily. "It soothes."

"I believe you would fatten on melancholy. A day like this gives me the blues. Even the sound of the Cathedral bells is moist. Listen to them."

"I've been listening to them for the last five minutes. There's something in the sound that passes into the mind and echoes there. The spring is in the air this morning, Ralph."

"I wish it would get into the earth. I'm sick of your gloomy English winter. Raymond, I wish you had once felt the exhilaration of our cold, ringing American winters."

"I wish I had, Ralph, I might be able to sympathize with your disgust."

Ralph left the window and flung himself into an arm-chair beside Raymond.

"Say, Ray, if I should start for home, would you come with me?"

Raymond commenced to study the floor. After a while he turned to Ralph.

"Yes, I think I would. I have come to rather like the idea, since you first spoke to me of it. Do you know, I fancy something is driving me out of Eastchester? But what's moving you, Ralph? You can't be thinking of leaving the country . . . unless Miss . . ."

"That's just it, Ray. I fear that with this hope of mine, as with everything else I have striven for in life, I'm doomed to failure."

Winter arose and began to pace the room.

"The curse of incompleteness," he continued bitterly, "is upon everything I touch. I am permitted to open the gate so that I can catch a glimpse of what's within, but I never can open it wide enough to pass through."

"Nonsense, Ralph. In this particular matter I can't see what reason you have for despair."

"Because, Raymond, you don't love the girl. Love is hedged with subtle intuitions. Of late I have had a persistent foreboding of disappointment. Why, do you know the very atmosphere and character of my surroundings here seem to have changed. The—what shall I say?—air of permanence, of settled relationship with the things around me has quite gone."

"You are moody, Ralph. It's a passing humor."

"No, no, Ray. The *something* I have been expecting seems to have gone by. I have become merely a lingerer."

"Nonsense, Ralph. You've got a bad case of weather affliction. When the sun shines again you'll be all right."

"I wish I could think so. This is not a new feeling. It has been growing with me for weeks. Rain or sunshine has not affected it. The source is elsewhere, old man."

"But—Ralph—have you—spoken to Miss Pilgrim?" Raymond's voice faltered a little.

"Why *do* you insist upon calling her Miss Pilgrim with me," asked Ralph, irritably. "Say Marian. I want all the music I can get before . . ."

Ralph finished the sentence on the piano with three or four melancholy, wailing chords which he struck half unconsciously.

Raymond went over to him. Putting a hand on his shoulder, he said softly :

"You haven't answered my question, Ralph."

Ralph's fingers continued to move idly over the keys.

"No, Ray, I haven't spoken. But I have tried. Always I have met what is even worse than inhospitality to my desires—an impossibility of recognition. I don't believe Marian will ever marry."

Raymond winced. Ralph continued to play. After a moment Raymond asked :

"What makes you think that?"

Ralph wheeled around quickly on the music-stool.

"You remember when Miss Craik and John Dix were married? Well. As the two left the church I whispered to Marian, 'They are so happy, I envy them.' 'Why do that,' she asked, 'when there are so many ways of being happy?' 'But none like that,' I said. 'Yes, many ways quite as pleasant,' she replied. 'Wouldn't you marry?' I asked. It was all I could do, Ray, to conceal my trembling. She was silent for a moment, then answered my question in that serious, thoughtful way of hers as though she were making some declaration of faith. 'I don't think so, Mr. Winter. I don't think it's possible now.' I need not tell you this took the heart out of me. It was said so plainly, as though I was the remotest person from any possible relationship with her. Since then I have not dared, even in the most distant way, to approach the subject again."

"But that is three months ago, and in three months, Ralph, how many times can a woman change her mind?"

"But not Marian, Ray. She is a creature full of dreams and fancies, yet so constant. Mrs. Carroll told me that Marian once said to her that she *knew* the man she would marry, if she married at all. Mrs. Carroll says she believes that is exactly so, Marian is always dreaming. I am not he, Ray. My destiny isn't a happy one."

"Destiny is not troubling herself about you Ralph. She has bigger affairs to attend to. Just at present, for instance, she is very busy in your country preparing a new theatre for a new world-tragedy, comedy, idyllic drama or roaring farce. Like the soubrette in the first act she is spreading the table

now, and History with all the great actors will follow by and by. How important you make yourself with the notion that Destiny's busy with you."

Ralph smiled.

"I suppose a man's little toe is larger than the universe when there's a pain in it; but, Ray, I've no hope and I'm blue, and if it wasn't for you I'd—I don't know where I'd be."

"Don't talk that way, old man, it's weak. Cheer up, you're under the weather. When it clears up you will see what everybody sees, that Miss Marian's in love with you."

"Who sees it? Who says so?" asked Ralph, eagerly.

"I see it. Mr. Wart sees it. Mrs. Carroll, here, sees it," answered Raymond, warmly. "Who doesn't see it, but you—because (into Raymond's voice there came a deeper accent) you are in the light, Ralph, and we are in the shadow."

"What's the matter, Ray?"

"Matter? Nothing, except that it pains me, Ralph, to see you so foolishly despondent over fantasies. Marian is in love with you; don't you hear it in her voice which grows sweeter and softer every day and remoter like the voice of one that lives in dreams? don't you see it in her eyes which reveal more from within than penetrates from without? don't you perceive that the power of the mystery is with her, and everything she touches is blossoming for *you*? Why, I'd be willing to die"—Raymond's voice suddenly fell and passed into quite another key—"willing to die if I could see you together and happy. I love both of you."

Raymond was perilously near to tears. He was looking into Ralph's face.

"Why, Ray, you're sick; how pale you are," cried Ralph, springing forward. "Lie down on the sofa."

"It's those strong cigars of yours, Ralph. I will lie down. Don't mind, I can make myself comfortable. Play to me—your marriage song, Ralph. Marian is here in spirit, play to her."

Raymond closed his eyes so that the music might not be interrupted. Instantly he felt its spell. Feelings that a moment before had cried to him so poignantly seemed to be absorbed into a tenderer medium and float

away like music of his own making. It was so natural that Marian should love Ralph; of her love for Ralph there could be no doubt. As for himself what was he but an interloper, torturing himself by taking part in a play that really did not concern him. Dear old Ralph, impetuous, impossible Ralph, wrestling forever with his own shadow and crying that the Powers of Darkness are leagued against him. How absurd! when a word would loosen Life's one enchantment and dissolve the prosy world—dear, how the music suggests it—into moonlight and purple shadows and living silences in which the unspoken word to fulfill the soul desire trembles at the point of utterance. In Ralph's present frame of mind doubt may rule until—what is he playing? How that music soars. The eye follows the lark and, as the little singer fades, is lost—in a vision of Heaven. Why could not I speak or hint to Marian. She will understand. She is to be here this evening. Why not speak at once? There, that is the measure, the full chords, the straining notes, the cry of joy, the heart's jubilation.

"That's splendid, Ralph," cried Raymond, rising. "Splendid—splendid, old fellow. You and Marian shall leave the church to it, if I can only get somebody to play it."

"Do you like it?" asked Ralph, smiling, pleased.

"You never did anything better."

"It came to me instantly like a thought, upon changing the key of what I had been playing. Look. So."

Marian was a regular visitor at the Carroll's on Sunday afternoons. For years she had devoted that part of the week to her old friends. On Sunday, after dinner, the great historian took a nap, and as soon as his eyes were firmly closed on the big sofa in the library, Marian would slip over to the organist's. Formerly the visits were short, but upon Ralph's arrival they were lengthened, until at last they frequently extended well into the evening—that was when Ralph was in a playing mood, or when the conversation happened to stride into a lengthy and interesting road. When Raymond joined the circle the later hours became the rule, and the cathedral clock usually had struck eight before Marian set out across the Close for home.

The rainy weather on this particular Sunday began to break up shortly before sunset. The dark sky opened low on the Western horizon and revealed a further heaven beyond, of pale blue suffused with a watery yellow light that shot out from under the distant edge of sombre, purplish clouds, and colored the twilight. The wind had died, but the moisture still dripped from the eaves of the house and the bare, black branches of the trees. The little party had broken up earlier than usual for the purpose of taking advantage of the better weather by walking over to Marian's for tea. Mr. and Mrs. Carroll had gone to their rooms to prepare for the street, and so had Ralph to his for the same purpose. Marian and Raymond were alone. Marian was sitting by the window. To Raymond who was watching hidden in the gloom, her form appeared as a dark shadow outlined against the pale brightness of the far West. Her hands were folded listlessly in her lap. She had passed for a moment into reverie watching the twilight. Every movement of thought toward the purpose Raymond had set before himself in the morning stirred his heart so violently that he almost feared Marian would hear it. The silence was like a heavier atmosphere that encompassed him about and prevented action. He could hear his thoughts, and once he felt sure that they had become audible. But no, Marian didn't stir; the only sounds were the ticking of the clock and the irregular dripping of the water. The yellow of the sunset changed to crimson. The bare trees and their gaunt branches grew darker against the sky and shuddered as a little gust of wind like a belated bird hurried past into the night.

Raymond's thoughts were in a tumult—they were crowding in upon him from so many quarters. They vanished suddenly when Marian said:

"An evening like this seems to sing the nocturne Mr. Winter played. Looking yonder one can hear it so clearly."

Raymond crossed the room to her side at the window.

"Yes, it is the very spirit of a moment like this, and Ralph plays it exquisitely."

"Exquisitely," repeated Marian, softly. "Exquisitely. But it is almost too sad, such a hopeless cry, neither to God nor man."

"Yes," said Raymond, struggling to shake off the terrible feeling of constriction around the heart. "It—have you noticed—I think Ralph is very unhappy, perhaps that is why he plays it."

"I hope not," exclaimed Marian with a little surprise. "I would be sorry."

"Yes," said Raymond, interrupting eagerly. "I was sure you would regret it. I have been troubled of late to see the change in Ralph. He is so sensitive—where—his feelings are concerned."

Raymond stumbled badly with the last sentence. Marian didn't perceive the drift of it.

"Yes," she said, vaguely, and then added dubiously: "I thought Mr. Winter obtained a great deal of satisfaction from his work at the schools. He told me he had never been happier."

"Miss Pilgrim, do you know I am afraid Ralph has learnt more at the schools than he has taught."

Marian noticed a change in the tone of Raymond's voice. She raised her eyes quickly to his, but the light was not strong enough for her to see his face clearly.

"I don't quite understand."

Raymond's heart was struggling violently. He had to grip the back of Marian's chair with one of his hands as he said:

"Oh, Miss Pilgrim, pardon me—understand me; Ralph loves you."

The startled reply that followed his speech struck him like a blow.

"No, no."

Marian arose from her chair, threw one glance at Raymond and then buried her face on her hands.

"Forgive me, Miss Pilgrim, forgive me. I had no idea I could be mistaken. Oh, I am so sorry. It was for Ralph."

Raymond approached closer to Marian, and as he did so her hands fell to her side and she turned her face for a moment full to his. The movement was eloquent of a

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momentary powerlessness, a mute appeal. In an instant Raymond's hand was in hers.

"Oh, Marian," he cried.

The room and the yellow twilight mingled and spun around him. Then he felt a hard grip upon his shoulders. The face that he had seen on the beach at St. Michael's, years ago, was again peering into his out of the darkness, the same blood-shot eyes, the same ferocious scowl, so distinct this time that every lineament was visible. He heard Marian's voice crying in alarm:

"Mr. Winter!"

The sound seemed to dispel the giddiness. He felt Marian pressing him gently into a seat.

"Did he hurt you?" she asked.

"Who? Oh, no! It is only a dream; a silly phantasy that came to me long ago at St. Michael's."

"Crying, Marian? What have I said? Oh, here's Mr. and Mrs. Carroll! Where's Ralph?"

"He ran out," answered Marian, struggling to hide her tears. "He must be in the garden."

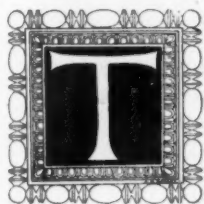
But Ralph was not found that evening.

To be continued.





NEEDED IMPROVEMENT IN PLASTER FOR WALLS AND CEILINGS.



HIS paper relates to one of the more important and the most neglected feature of the art of building; namely, the plastering of walls and ceilings.

Though it may contain nothing new and therefore interesting to the learned architect, whose profession implies a thorough knowledge of every art and detail relating to construction, it must be kept in mind that others less informed are variously interested in the execution of the structures which he originates and lays out; as, contractors, masons and plasterers, carpenters, decorators, plumbers, glaziers, painters, etc., and especially the *owners* and *occupants*. These (and possibly some architects as well) may find herein suggestions, relating to the subject in question, which have not hitherto been brought to their notice.

When it is considered that forty millions of the sixty millions of barrels of lime, annually produced in this country, are applied to walls and ceilings, the magnitude alone of the subject of plastering would warrant greater consideration than it has received.

Not long ago houses for homes, as well as public buildings of any pretension, were fashioned substantially in accordance with certain lines, forms and proportions laid down by architects of olden times, which were to be no more deviated from than religious dogmas; while ordinary resident houses, particularly in country districts and villages, were as devoid of architecture as dry-goods boxes, barren alike of beauty, comfort and convenience.

But, within the last fifty years or so, these arbitrary rules of earlier architecture have yielded their sway; so that *now*, when a person would erect a structure for his home, instead of seeking to build as others have built, he strives to originate a plan that will so far differ from dwellings of his neighbors that it shall have not only an identity of its own, but if possible, embrace more and finer lines and forms of grace and beauty, and more harmoniously blended shades of color, and include a more desirable arrangement of rooms, closets, nooks and corners, promotive of satisfaction, comfort and convenience, than any house previously built. This may be said also of various public buildings, including even churches—though churches, temples and cathedrals doubtless retain more of the styles of former times than any other class of structures.

After the days of Rome, until comparatively recent times, architects were more ambitious to adhere to classic lines, and further develop the fine-art elements of construction, than to study utility, ever seeking for those fine and exquisite combinations of forms, harmony of colors and decorations, which they supposed could be so far discovered and developed as to yield no less rapturous delight to our vision than music affords our hearing. But the later leaders of the profession, recognizing the new and more practical demands of modern developments, have given greater attention to utility and adaptation to present needs, which has resulted in producing more desirable dwellings and more practical public structures, embracing, if not so much of the heavy, massive grandeur of exceptional samples of ancient and me-

diæval times, yet greater usefulness and more general variation of architectural beauty.

Hence our cities, villages, and even country districts, are studded with an endless variety of cosey, beautiful and homelike dwellings, which, together with our innumerable banks, exchanges, office-buildings, blocks of flats, club-houses, warehouses, railroad stations, hospitals, town-halls and other civic structures, insurance offices, picture and other art galleries, theatres, museums, colleges, etc., present throughout all the more civilized nations a variety and general picturesque display of practical architecture undreamed of by architects of former ages.

Besides this advancement in external beauty of residential and other structures, various improvements have been made in the choice of building materials, as a better selection of stone and extended use of iron and terra-cotta; and *internal* modern conveniences of every kind have been provided, as steam-elevators, gas, water, electric-bells and lights, annunciators, speaking-tubes, heating apparatuses, ventilators, toilet-rooms, etc.; and great progress has also been made in fine finishing, including an endless variety of polished hard-wood finish, moldings, panels and carvings, tiled floors, plate-glass windows, chandeliers, mirrors and carpets, and all kinds of better hardware, from locks to window-catches; until no pains or skill have been spared in perfecting, decorating and beautifying our dwellings and other structures to the completest degree, except in the matter of *plaster* employed for walls and ceilings, which, instead of having kept pace with other improvements, has *deteriorated*, not being as good now as it was years ago.

In fact, most of the plastering of the present time is of such inferior quality that its failure to stand often causes the destruction of paper embellishments, painted and other wall decorations far more costly than the plastered walls themselves.

No art in the economy of building accomplishes so much to produce internal neatness and elegance, and no one is more absolutely important, as far as

the use and stability of the structure is concerned, than that of the plasterer. Plastering of walls and ceilings constitutes the completion of *five* of the six sides of every room, hall and closet, and hence it is the *chief* part and finish of the entire interior of all residential and most other structures. Therefore, there must be some explanation, which possibly may be found in this article, why the art has not been, from time to time, correspondingly perfected with other building improvements.

The very general practice of plastering walls and ceilings is of comparatively late date. Not much more than a century ago walls were wainscoted and ceilings boarded (or boarded and canvassed), or left with naked joists, both in England and on the Continent. The mediæval school of architects, which, with the cry of "no shams," would return to this style of finish, is forced to admit, after all, that good cementitious plaster is preferable to wood for walls and ceilings.

To supply many needs, especially in the different departments of construction, thorough research has been made throughout the world for materials from which to make various plastic cementitious mixtures that will set and become hard, even in water as well as the air. The variety and extent of the requirements of such mixtures are very great—from submarine foundations to delicate works of art; but for no one purpose are they more useful or more extensively employed than for walls and ceilings in building. For this purpose (as the principal ingredients) none have been or are likely to be discovered superior to or less expensive than carbonate and sulphate of lime.

Even hundreds of years ago cementitious ingredients were treated and combined in such manner and proportions as to produce a fine imitation of polished marble, and of any desired color, but at such great cost as would preclude its common use for walls and ceilings.

In later times were provided other cementitious mixtures, among which may be mentioned what is known as Parian cement and Keene's cement, which, though less costly than artificial

marble, are nevertheless by far too expensive for this purpose.

And now, that is within the last three or four years, an improved wall plaster, consisting of better materials than simply lime, sand and hair, has been discovered, and which, by employment of steam power and machinery in its production, instead of hand labor and utensils, can be provided at the same cost of fair quality of common plaster; and which is being rapidly substituted therefor, and (except delayed somewhat by prejudice against innovations on the part of plasterers) will soon be generally adopted.

It is claimed by some architects that sufficiently fine plaster for walls and ceilings *can* be made from simply good lime, sand and hair. This may be admitted, provided the mixture of the lime and sand be allowed to remain a long time "in stack" before it is wet up for use, and provided also it be sufficiently worked or mixed to insure homogeneity, and provided, too, the hair is not worked in until the time the plaster is wet up for use (as otherwise the lime would destroy it). But plaster thus made, and by hand labor, though it contain only lime, hair and unwashed sand, will also (like the Parian and Keene cements) cost more than can be afforded for ordinary use on walls and ceilings—and even this quality of simply lime plaster will not resist the action of water.

But, by the use of the right proportions of both carbonate and sulphate of lime, modified by a small quantity of other materials, and by use of properly treated sand, and other fibre than hair, and the employment of an extensive and well appointed plant, it is known to be not only possible, but eminently practical to produce a more cementitious, harder, stronger and therefore more nearly germ-vermin-water and fire-proof, and less costly wall plaster than it is possible to make from simply lime, sand and hair, and at such a moderate cost that it will compete in price with ordinarily good common plaster.

To those who are contemplating the building of residences or other structures, and are not familiar with the sub-

ject of wall plaster, an explanation of the *indispensable requisites* of the best production, from any special or whatever cementitious materials, will doubtless be of interest. These are:

1st. Suitable quality and *preparation* of the materials, especially the *sand*; 2d, proper *proportions* of the several ingredients, and 3d, thorough and uniform *mixing* of the same—neither of which requisites are or can be strictly or even approximately complied with in making wall plaster by the usual means employed, as will be hereafter shown.

First: As to the materials. Whatever may be employed for the cementitious constituents of the plaster—whether lime, gypsum, Portland cement or any combination of these or others—the sand, which is always a component part, must be of the best and silicious quality. The harder and sharper it is the better, and therefore it should be either river, bank or pit sand. Sea sand is objectionable, because its particles are rounded by attrition, caused by the action of the sea, which makes it less efficient than sharp, angular sand, and for the reason too that it cannot be entirely freed from a saline taint whereby it gives the walls a tendency to attract moisture. It is evident that the sand should not be too coarse, and it must not contain any very fine particles. It must be free from all foreign substances. Hence, as no sand is ever found in this condition, it must be submitted to treatment; that is, its very fine and coarse particles must be *screened* out, and all dirt and dust *washed* out, until it ceases to discolor the wash-water, and then *kiln dried*; for the very fine particles of sand itself, dirt, dust and water (before wetting for use) only weaken the strength, diminish the hardness and deteriorate the color of the plastered walls.

As an evidence of the superiority of prepared sand, it has been demonstrated that the *poorest* lime with sand *thus treated* will make better plaster than the *best* lime with ordinarily good *untreated* sand—yet poor lime should never be employed.

Though it is supposed that the admixture of sand originally was for the purpose of saving lime and preventing

shrinking, it is now assumed to have a valuable chemical function, causing the formation of a hard silicate of lime, pervading and thus strengthening the plaster. Walls also become harder, in time, by gradual conversion of the hydrate into carbonate of lime.

As to the cementitious ingredients, it is not the purpose of this paper to give an account of the various materials used, their relative proportions and the process of their combination in the production of the improved wall plaster cement alluded to; further than to mention that the chief cementitious ingredients employed are lime and gypsum, and asbestos for fibre.

Pure lime (which is an oxide of a metal, known in chemistry as calcium) does not exist in a natural state, but is abundantly found in the conditions of carbonates (common limestone) and sulphates (gypsum, yielding plaster of Paris). Limes are generally classed (since the publication of the work of Vicat), as (1) rich limes, (2) poor limes, (3) lime slightly hydraulic, (4) hydraulic limes, and (5) eminently hydraulic limes. Only the first two are suitable for making wall plaster, and only the *first*, or rich limestones, which are the purest oxides of lime (and therefore the whitest), should be employed in the manufacture of an improved wall plaster cement. Poor limestones contain silica, magnesia, manganese, or metallic oxides, and, therefore, are liable to vitrify and discolor in burning, and do not slake as freely as *rich* limestone.

Second. Relating to the proper *proportions* of the materials, it is evident that the best wall plaster (whatever cementitious ingredients may be used), depends also upon some *definite relative proportions* of the sand and other materials employed, which if in the least deviated from will correspondingly deteriorate the product.

To produce the hardest, most compact and strongest plaster, from any given materials (so far as dependent upon proportions), the amount of lime (or whatever cementitious materials are used) must be sufficient and only sufficient to fill the voids or interstices of the sand. If more lime is employed

the walls will not be so hard; if less, not so strong and compact. But as the amount or sum of the voids or interstices in different grades of sand greatly vary (in the extreme as much as 18 per cent), this fact must also be kept in mind in proportioning the other materials, so as to meet the requirements of the grade of sand employed.

By a series of experiments these proportions can and should be ascertained, and, in the production of wall plaster, be strictly adhered to by automatically or otherwise weighing all the materials before they are mixed. For, without regard to chemical law of proportions, the best results are no more attainable in the production of wall plaster than desired qualities in the treatment of iron, steel or any other product involving whatsoever chemical action. Chemical, nor any other natural law recognizes cupidity or convenience of plasterers or whomsoever; there must be unqualified compliance, or failure follows.

Third. Relating to the *incorporation* of the materials, it is also evident that, though the several ingredients be of good *quality* and properly *prepared* and put together in the *correct proportions*, that the perfection of the plaster will still greatly depend upon their incorporation; that is, the several ingredients must be so thoroughly and uniformly mixed together that every *infinitesimal part* of the mixture shall be homogeneous and consist of the required definite proportions.

As it requires, for instance, about a hundred thousand pounds of dry materials (sand and lime) to plaster the walls and ceilings of an ordinary sized city dwelling, and as these (to obtain the best results) must be so thoroughly incorporated that not only every ounce but every particle of the mixture shall consist of the specific average proportions of the ingredients, it becomes apparent that the necessary power and machinery for performing this part of the work alone, to say nothing of the required power and apparatus for treating the sand, as heretofore described, renders it absolutely impossible to make perfect wall plaster by the method now universally employed, or by whatever

method, at the buildings where it is to be used.

In view, therefore, of the great amount of labor indispensable to the production of suitably made wall plaster nothing could more forcibly demonstrate the advantages of labor-saving methods and devices than the handling, preparing, weighing and properly incorporating its ingredients by an extensive and well-appointed plaster manufacturing plant.

From what has already been said it may be inferred why plastering of walls and ceilings has not only deteriorated, but also why it has not improved; yet, other reasons are naturally suggested.

Though it may be no exception to the prevailing tendency in business transactions generally, unfortunately the interests of the owners of buildings and the masters of the various artisans concerned in construction are more or less conflicting. To state it mildly, the former desire and demand of the latter as *good* materials and workmanship as are specified and contracted for; while the latter strive to furnish no *better* materials and work than specified; and usually the latter come out ahead—especially is this the case with the plasterer, as will appear:

1st. The difference between good and poor plaster, whether off or on the walls and ceilings, is not apparent; 2d, one of the two chief ingredients (the sand) may not be well selected; 3d, this ingredient, however inferior, may not be properly treated; 4th, the materials may be proportioned by chance, and so not with any accuracy; 5th, the ingredients may not be homogeneously mixed; 6th, formerly no improved wall plaster has been produced at a cost that could be afforded.

To enlarge a little on these points:

First: If, for example, slate were specified for roofing, mahogany for doors, Philadelphia brick for front wall, plate glass for windows, etc., the contractor would not have the hardihood to employ other materials, as any substitution would be evident. But however specific be the wording of the specification for plastering with lime, sand and hair, there are, owing to the

usual manner of preparing plaster, no means of determining with any accuracy whether or not the architect's specifications are strictly complied with; hence the plasterer's integrity is severely subjected to the fascinating temptation of a liberal use of sand, and often of inferior quality as well. Besides, the greater part of *his* work is concealed from view by the so-called hard finishing coat, which gives his work the appearance of being all right, irrespective of the merits or demerits of the cementitious quality of the body of his plaster. Hence, the temptation of this important artisan to slight his work is quite equal to that of the dairyman to water his milk—who finally came to need statutory aid to regulate his traffic. In fact, the architect and contractor are more or less obliged to consult the statutes for guidance—but plasterers have methods and secrets which none may question.

Second: As to selection of sand, it is frequently not selected at all, the dirt excavated for the cellar and foundation being used. If a selection is made, it is oftener governed by convenience and cheapness than by its suitable quality; hence, usually, instead of using clean, sharp river or pit sand, a mixture of indifferent sand and dirt is employed.

Third: As to the *treatment* of the sand, this is never done, except it contains stones and pebbles as well as dirt, when, to exclude these (the stones and pebbles), it is simply thrown upon a coarse slanting screen. No sand, however well selected and free from dirt, is as good without as with treatment; that is, *screened, washed and dried* as and for reasons before given. Such poor grades of so-called sand are often used that, if submitted to the above treatment, would not yield a fifth of their weight of proper quality.

Fourth: The *proportioning* of the sand and lime is only guessed at, the sand being scraped and thrown into the slacked lime haphazard, with hoe and shovel, without regard to quantity or exact proportions, whereby one batch of the mixture is liable to have a much greater or less proportion of sand or lime than another.

Fifth: As to the homogeneous *incorporation*, it is simply impossible by hand labor and hand implements, at any tolerable cost, to sufficiently incorporate sand and lime (or whatever cementitious ingredients) to insure the best results.

If a small quantity of plaster, prepared in the usual way (however superior the several ingredients, or however correctly they are proportioned), is examined with a magnifying glass, when being applied to the lath, it will be found that minute and even larger portions of it contain more than the average proportion of lime, and other portions a greater quantity of sand, whereby the plaster, when dried on the lath, will not be as strong, hard or uniform in appearance as it would were it more thoroughly worked or mixed—in some spots it will be nearly all sand, in other places mostly lime.

Much of the common plaster now used for walls and ceilings is so poorly made that it is self-disintegrating and crumbles away wherever the finishing coat is broken, and for strength is largely dependent upon the employment of hair to assist in holding it from falling to pieces for lack of inherent cementitious properties of its ingredients.

While some suitable fibrous material may be advantageously employed, it is absurd to chiefly rely upon it to hold the particles of plaster together, after the fashion of holding beads together with a string, instead of depending upon the hardness of the set and tenacious quality of the cementitious materials.

As regards hair, especially tropical cattle hair, it would seem that it is the foulest material for the purpose that could be selected. In fact, were it not for the disinfecting properties of lime, it would breed infection in every household. Hence, in view of health and wholesomeness, some vegetable or mineral fibre, as jute or asbestos, would be preferable; while the employment of asbestos has the advantage of rendering dwellings and other buildings more fire-proof.

Plaster (as ordinarily made), for lack of tenacity, resulting from want of sufficiently cementitious ingredients or, by

having inferior, or too much sand, or both, necessitates a greater thickness of it than otherwise would be needed, whereby the building becomes too heavily loaded, and (at first) unnecessarily saturated with water; whereas, a stronger, harder and quick-setting plaster would not require the walls (unless desired) to be so thickly coated. Besides, with such a plastering cement, more of the water would be absorbed by the set, and, therefore less of it evaporated to swell and injure the woodwork throughout the structure. And, too, by the use of such plaster, much delay would be avoided in the completion and occupancy of buildings, as the carpenter, with his work, could sooner follow the plasterer, and far less time, also, would be required for general drying of the structure.

Another unsatisfactory feature of common plaster is its porous and absorptive qualities, affording lodgment for moisture and germs of disease in damp weather, which, in turn, are given off by evaporation in dry weather; whereby it is not so wholesome, especially for hospitals, sanitariums, school-houses, and resident structures, as a harder, closer-setting and finer grade of plaster.

It is a well-known fact, learned by experience, that common plaster does not retard the progress of fire in buildings nearly as effectively as harder and more cementitious plaster, especially if, in the latter, asbestos is employed for fibre.

Another common and serious defect in ordinary plaster is what is technically known by the term "pitting," to understand the cause of which needs a little explanation:

Owing to the difficulty, if not impossibility, of burning limestone with perfect uniformity, so that all parts of it shall be sufficiently burned and none overburned, it follows that, when the lime comes to be used, it will not *slake* with uniformity. Some particles of it will not as readily slake as the bulk of it; and, therefore, when the mortar is made and stacked in piles, all the unslaked particles will go on slaking; and it is only by allowing the mortar to remain a long time (a year or more) in

this condition that complete slaking of the lime can be assured.

To save time and expense this is seldom if ever done. The usual practice is that as soon as a considerable quantity is stacked to commence immediately to wet it up and put it on the walls, and cover it over with the so-called hard finish, which for a while appears all right. But in course of time the penetration of air and absorption of moisture will continue to slake the particles of unslaked lime, which at first swell and cause little bulges to appear on the surface of the wall, which finally crumble away and leave little "pits" or indentations.

This blemish of walls cannot be avoided except, as before stated, by allowing the mixture of lime and sand to long remain in stack, and introducing the hair afterward, to do which makes even lime, sand and hair far more expensive than a superior quality of improved and more cementitious plaster, which is wholly free from this defect.

Still another objection to common plaster is its free absorption of water, and (if once wet) its consequent loss of tenacity and strength.

To this may be responded, that, in the use of plaster for walls and ceilings, it is not supposed to be subjected to the action of water, and that, therefore, its water-proof quality may be pronounced superessential. But this would be to suppose that vessels of water are never accidentally overturned, that roofs never leak, that water pipes never burst, that faucets are never left open, or that firemen never drench an entire structure to extinguish flame in a single room. In short, walls and ceilings are frequently exposed to the action of water, especially from defective plumbing; and wall plaster, therefore, should be sufficiently resistant of its penetration and effects to suffer no injury by, though long exposed to it; whereby ceilings would often be prevented from falling, and danger to life and expensive repairs avoided.

It has been demonstrated by experience that an inexpensive, hard cementitious plaster can be and is made which is impervious to water, and, though

frequently and for a long time exposed thereto, suffers no essential injury; whereas the average common plaster, if once thoroughly wet is practically destroyed; as shown by many a ruined wall and fallen ceiling, caused, perhaps, by a rat-gnawed pipe, a choked drain, or a driving rain-storm.

In view of the extensive application of paint as the final finish of walls, this porous and absorptive quality of common lime plaster presents also, in this respect, another economic objection in the extra expense of materials and labor for this class of finish. The cost of painting such walls being more than double that of similar treatment of a closer setting, harder and non-absorptive plaster.

It is also an objection to common plaster, that, not being sufficiently hard and resistant, the walls are subject to defacements and blemishes by unavoidable contact. Besides, as walls are liable to become soiled by dust, dirt and marks of discoloration, they should be sufficiently impervious to resist the penetration of water, to allow them (without injury) to be occasionally washed. Walls made of ordinary plaster cannot be subjected to such treatment, whereas suitably cementitious walls, having a correspondingly hard finish, could be thus cleaned as readily as slabs of marble, and without the slightest injury.

By the present method of preparing plaster on the street, the freezing weather of winter causes much unavoidable delay, not only of the plastering, but all other work that cannot progress until the plasterers are out of the way; whereas if the plaster were systematically manufactured and supplied, in a dry form, as above set forth, it could be handled and applied with the same facility in the winter season as at other times of the year. No mixing or further working of the plaster outside of the building being required, the plasterer could proceed uninterrupted either by storm or temperature; which is no inconsiderable consideration in point of convenience and economy of time and expense.

The uses of common mortar and wall plaster are so widely different that it is

possible and feasible to prepare the one by means that would be wholly inadequate to suitably make the other. Common mortar (consisting only of lime and sand), such as is used for building purposes other than for walls and ceilings, as also mixtures of sand and Portland and other cements, employed for concreting and other foundation work, may be advantageously prepared on or at the premises where they are to be used, for the various work to which such mortars and mixtures are applied has no reference to fine finish or sentient contact (touch and vision); therefore, with such mortars, *if only sufficiently strong for the purposes intended*, it matters not if the sand is not treated, or the proportion of the ingredients is not so exact, or their incorporation so complete. But it is altogether different with walls and ceilings. The plaster for *these* requires to be as much more *perfectly* made, and in every way as far *superior* to common mortar as the required fineness and superior finish of walls and ceilings exceed that of the work to which common mortar is applied. Common mortar requires but the *one* quality of strength. Wall plaster requires strength, hardness, elasticity, adhesiveness, solidity, infinitesimal homogeneity, germ-vermin-fire and water-proof qualities, surface finish, purity of color, reliability and every possible excellence. The nature of its use is such that its production should be classed among the highest mechanic arts, for no less desirable is the perfection of walls, especially of residential structures, than fineness of finish of woodwork and fittings.

Therefore, it is utterly impossible, as before stated, to make wall plaster on a sufficiently large scale to meet the demand of its use, by the indifferent and crude means heretofore employed, or by any other possible means which can be devised and operated on or adjacent to the structures on which it is to be used. As well might the painter grind his paints, the mason make his brick, the glazier his glass, etc., or each household make its own flour, sugar, etc., as for the plasterer to undertake to manufacture (on the premises) the best possible wall plaster.

This, doubtless, would be the view of all architects, building contractors, plasterers and owners (as it already is of many), were it not for the prejudice growing out of long usage, which, at first, opposes all new things and methods. But had wall plaster always been thus systematically manufactured and provided, and some innovator should suggest that the plasterer could just as well (and better) guess at the relative proportions of his indifferently selected materials, and throw them together on the street and stir them up with a hoe (to say nothing of the nuisance he creates by musing and incumbering the thoroughfare with his huge and unsightly boxes and piles of sand), he would be laughed at and set down as a crank; for it would be considered no less absurd than to suggest the abolishment of the plow and mowing machine, the cotton gin and loom, the flour mill and saw mill, or any other labor saving and perfecting process or device.

From what has been said, it may be correctly inferred that (regardless of cost) it is possible to plaster walls and ceilings with materials imitating veritable polished marble, or with such materials as come short of this in cost and hardness, like those known as Parian cement, Keene's cement, and others that could be mentioned, but which also would be, by far, too costly to be generally afforded.

Therefore, the great desideratum to be attained, as a plaster for walls and ceilings, is something that shall be harder, stronger, whiter, smoother, more cementitious and less porous than the inferior, hand-made lime and hair plaster, heretofore universally employed—something, in short, embracing every required excellence that the highest state of the art can provide, and which will comport with other building improvements of the age, but which, nevertheless, will not be (all things considered) more expensive than a fair quality of ordinary plaster, in order that it may be universally afforded and used.

But, owing to the necessary treatment of the sand and employment of more and better cementitious ingredi-

ents (than simply lime), such a desideratum (including the competitive price) is impossible of attainment, except by the substitution for hand labor of extensive and well-equipped plaster-manufacturing plants, whereby the plasterer is relieved of all labor in the production of his plaster, except adding water to the manufactured product.

While this is the only feasible method of making uniform, reliable and suitable wall-plaster, it is also the only means of removing the plasterer's besetting temptation, which has deteriorated his handicraft, measurably destroyed the usefulness of his art, and prevented him from keeping step with his associate artisans in the general improvement of the complex art of construction.

Viewing the importance of the subject in the light of the foregoing paper, *J. B. King & Company*, by extended study, numerous and elaborate experiments and expenditure of vast sums of money, have finally succeeded in attaining the desideratum of producing and putting upon the market, at the price of fair common plaster, an improved plaster for walls and ceilings, embracing every required excellence as above set forth.

The fact that they have, in their

Windsor Cement Dry Plaster, reached the highest point of excellence and perfection, and at a cost not to exceed that of fair common plaster, they establish, as to cost, by the prices they quote; and as to its *qualities*, by the numerous commendations of architects and builders throughout the country who, having demonstrated its merits by practical use, confirm all the makers claim.

It is manufactured strictly in accordance with the "Indispensable Requisites of Production" of the best possible Wall Plaster, as described in the foregoing paper; as well as having mineral instead of animal fibre (asbestos instead of hair), which renders it easier of application, more sanitary and fire-proof.

It is sometimes asked, in a significant manner, how it is possible to produce a far better article for the price of a poorer material.

Though such a question seems too foolish to merit a serious answer, we reply briefly by saying, that it is accomplished in the same way that thousands of other better products are had for the same price and even for less than poorer ones; namely, by *improved and radically different methods of production*.

For further answer, we refer to the foregoing Treatise.

J. B. King.

Comparative Cost of King's Windsor Asbestos Cement Dry Plaster and Common Plaster for Walls and Ceilings.

As there is among architects, builders, plasterers and owners of various structures much difference of opinion, and on the part of some plasterers no little misrepresentation as to the relative cost of King's Windsor Cement Dry Plaster and Common Plaster:

And as the question of *cost*, especially with the majority of owners, is of equal or greater consideration than that of *quality*, it is a matter of importance that more reliable information on this subject should be furnished than has been heretofore published.

Doubtless much misapprehension relating to the matter occurs from want of specific use of terms and a definite

understanding as to what is embraced when alluding to cost.

Therefore, to clearly present the case, it is necessary, first of all, to define what is included when referring to the cost of any particular kind of plaster.

The cost of common plaster (consisting of sand, lime and hair), up to the state of being stacked in the street, will depend upon various conditions, some of which are not easily defined, and, therefore, usually overlooked:

1st. The quality of the ingredients employed, especially the sand.

2d. The relative proportions of the materials used.

3d. The cost of labor for mixing and tempering, dependent on location, and thoroughness with which these operations are performed.

4th. The cost of transportation, also dependent on location.

5th. The length of time the plaster remains in stack before being wet up and used, whether for two or three days or several months.

Therefore, it would be absurd to say that common plaster stacked in the street will cost any specific sum per square yard of its covering capacity, unless the quality and relative proportions of the ingredients (as well as some of these other conditions), are stipulated and adhered to (which, owing to the indefinite and crude manner of making common plaster, is seldom expected, even though such stipulations are minutely specified by the architect).

The cost of common plaster, from the state of being stacked in the street up to the state of walls and ceilings, will also depend upon various conditions:

1st. The amount and price of labor employed in working it over or tempering it—whether it is merely wet up or thoroughly worked, to properly incorporate its ingredients.

2d. The depth of grounds—whether five-eighths, six-eighths or seven-eighths of an inch.

3d. The kind of lath employed—whether wood or metal—as well as upon the different qualities of these.

4th. Upon how far the walls deviate from a true plane—whether or not considerable depressions are to be filled up to level the surface.

5th. Upon what proportion of the work in the structure is on wood lath, and what proportion on brick and terra cotta walls—whether all lath or all brick and terra cotta.

6th. Upon the price of labor where the plastering is done.

7th. Upon the number, magnitude and elaboration of the cornices and centre-pieces.

Hence, it would be still further absurd to say, irrespective of these various additional conditions, that common

plaster, applied to the walls, will cost any specific sum per square yard.

As thus there is no uniformity of quality and conditions, and consequently no invariable *cost* of common plaster (either in stack or on the walls), plasterers widely differ in their estimates; varying (including wood lath and lathing), from 35 to 65 cents per square yard—while the difference for better grades of work, with common plaster, will be still greater, and cost still more, being a dollar and upward per square yard.

It is not uncommon for plasterers to differ by several thousand dollars in their bids for plastering the same structure, though their estimates be made up from the same specifications.

The cost of plastering a building is estimated by the number of square yards of its walls and ceilings, embracing all necessary materials and labor, including the lath and lathing, cornices and centre pieces, plaster and plastering.

But the lath and lathing, the materials and labor for the cornices and centre-pieces, and the materials and labor for the finishing coat, and the labor for applying the plaster that constitutes the scratch and brown coats (on a given structure in accordance with given specifications), will not vary in cost whatever the kind of plaster used for the scratch and brown coats. Therefore, the cost of all the materials and labor, except what is necessary to the *production of the stacked plaster and its tempering* (needed for the scratch and brown coats), may be eliminated from the calculation in estimating the relative cost of common plaster and Windsor Cement Dry Plaster, which practically narrows the question down to the *comparative cost of common plaster stacked, wet up and tempered; and Windsor Cement Dry Plaster delivered, also ready to be wet up.*

As common plaster can be (and often is) made of such poor grades of lime and ruinous proportions of inferior sand, and as, on the other hand, it is possible to make it to cost even a dollar or more per yard, it is not proposed to compare the cost of Windsor Cement Dry Plaster either with the cost of the *poorest* or *best* common plaster; for, as

the poorest is totally unfit to use, while the best is too expensive to be afforded, it is evident that it would be altogether inconsistent to compare the cost of Windsor Cement Dry Plaster either with a *worthless* or a "*fancy*" grade of common plaster.

In fact, it is misleading, unjust and absurd to flippantly say that Windsor Cement costs more than common plaster without stating what grade or quality of common plaster is referred to—as otherwise it may be anything from *mud* to a fine grade of work, costing not less than a dollar and a half per square yard.

Therefore, that there may be some definite understanding as to what is meant by the term common plaster, we will designate no *fancy* quality, but select a formula which is well known, and which all architects, builders and owners, as well as all *fair-minded plasterers*, will admit is no better in quality than is absolutely required for ordinary fair work; namely, the formula laid down by Col. Gilmore, of the Corps of U. S. Engineers, as to the required *materials* and their *proportions*; and as to the *prices* of these and the *cost of labor* for mixing them, we will take the present quotations in the New York market.

This formula of Col. Gilmore is recognized as the standard by the Government, and as authority by publishers of statistical books.

It will be seen that it does not call for treated sand, beyond ordinary screening, or require the mixture to stand any length of time in stack.

Col. Gilmore's Formula for Common Plaster; Materials and Labor at New York Prices; for Scratch and Brown Coats, Stacked, Wet Up and Tempered, Ready for the Hod; for 100 square yards, measured on the Walls, and 3-4 inch grounds on Wood Lath:

Lime, 4 casks at \$1.10.....	\$4 40
Hair, 4 bushels at 25 cents.....	1 00
Sand, 7 loads at 75 cents.....	5 25
Labor for mixing, stacking and tempering	3 50
Total.....	\$14 15

Being, per square yard, 14 15-100 cents.

This estimate calls for no more labor

than is required for the most ordinary incorporation and tempering.

Neither does it include the cost of carting, to and fro, necessary lumber for, or setting up of mixing-boxes, etc.; or wear and tear of mixing-tools, or various disadvantages of unavoidable delay. Hence, no exception can be taken to the citation of this formula and grade of plaster, or its estimated cost in making the comparison.

J. B. King & Company, sole patentees and proprietors of the above material, furnish Windsor Cement Dry Plaster, deliverable at any building within the cities of New York, Brooklyn, Jersey City and near-by places connected to the said cities by water transportation, at the rate of \$7 per ton, and allow the purchaser a rebate for bags returned, at the rate of \$1.30 per ton, which makes the price \$5.70 per ton, ready for use, simply by adding water to wet it up, the covering capacity of which, on wood lath, is from 60 to 65 square yards per ton, making the price from 8 3-4 to 9 1-2 cents per square yard.

Besides, the covering capacity of this material is fully ten per cent. greater than common plaster, owing to the requirement of some less space between the lath.

Common plaster, as per Col. Gilmore's formula, per square yard, 3-4 inch grounds, wood lath, 14 15-100 cents; King's Windsor Cement Dry Plaster per square yard, 3-4 inch grounds, wood lath, 8 3-4 to 9 1-2 cents, which is an average of 9 1-8 cents per yard.

Hence, it is shown that fair common plaster, ready for the hod, *costs five cents per square yard more* than Windsor Cement Dry Plaster also ready for the hod.

The result of the above estimate is not changed or in any way affected by the thickness of the grounds, or style of lath used, or by whatever walls are to be plastered—whether wood or metal lath, brick or terra cotta walls or walls that are out of true—for the reason that the comparison shows that Windsor Cement Dry Plaster is cheaper than common plaster, *ton for ton*, whatever be the use to which it is applied,

even if it were to fill up a mountain cave.

Therefore, when plasterers say that Windsor Cement Dry Plaster costs more than lime and hair, they must refer to a very inferior grade of common plaster—a quality that no reputable architect or thoughtful and prudent owner of any structure is willing to accept.

Plasterers in some instances who, having contracted to do certain buildings with common plaster, and afterward having been requested to state what they would charge extra to substitute Windsor Cement, have raised their price, over and above what they had agreed to do the same work for with lime and hair, to such a sum that the *extra* price alone would purchase double the quantity of this cement necessary for the entire work.

In a case like this, what must be the conclusion of the architect and owner as to the quality and cost of the common plaster that the plasterer is expecting to use on the job. Surely this is a "hint to the wise" that should be "sufficient" to convince the owners that plaster and plastering are of the variable and uncertain features of the art of construction.

As it is so frequently the case that plastered walls are sooner or later finished by painting them, it becomes pertinent, in connection with the relative original cost of *plastering*, to refer to the comparative cost of *painting* them, if plastered with different materials.

Relating to this feature, it has been repeatedly demonstrated that, owing to their non-porous and therefore non-absorptive qualities, the cost of painting Windsor Cement walls is not equal to *one-half* the expenses of painting those made of common plaster; which, though viewed from only an economic standpoint, is a matter of no small consideration.

Naturally associated with the comparative *cost* is the relative *merit* of plasters.

J. B. King & Co. have already sold over a million barrels of their Windsor Cement for plastering walls and ceilings, with which *plasterers have mixed*

their own and all varieties and grades of sand, and considering that architects, builders, plasterers and owners have universally admitted its superiority, it is deemed superfluous to even allude to its merits as compared with common plaster.

Notwithstanding the extensive demand for and universal appreciation of their Cement, they had until recently necessarily taken the chances of trusting to thousands of masons and plasterers to select and proportion the sand, which in many instances has been inferior and two liberally used, whereby their material, in not a few cases, has unjustly suffered deterioration and consequent discredit.

Appreciating this, and seeing that they were thus more or less in the hands of others, and, therefore, held responsible for results over which they had no control; and realizing the extensive and growing demand for a perfect and always reliable wall plaster; and knowing the utter impossibility of producing such a plaster unless they could determine and control the *quality, quantity, proportion and incorporation of all* the ingredients that enter into its composition (except the addition of water to wet it up), they have established, in connection with their mills, an extensive and expensive *sand-treating plant*, whereby they now simultaneously incorporate the correct proportions of a proper grade of silicious sand with their Windsor Cement.

They select the best pit, bank or river sand to be had, screen out all its fine particles, wash out all dust, dirt and foreign matter, kiln-dry and thoroughly incorporate it with the cement—all the materials (even the fibre employed) that enter into the composition being of the best quality and automatically and accurately weighed before being mixed.

In short, their Windsor Cement Dry Plaster is manufactured in strict compliance with all the *indispensable requisites of production* of the best possible wall plaster as set forth in the preceding Treatise.

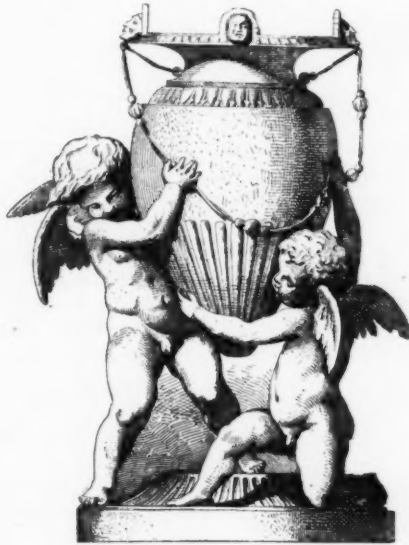
Their Windsor Cement Dry Plaster, therefore, is now as reliable and perfect as in the present state of the arts

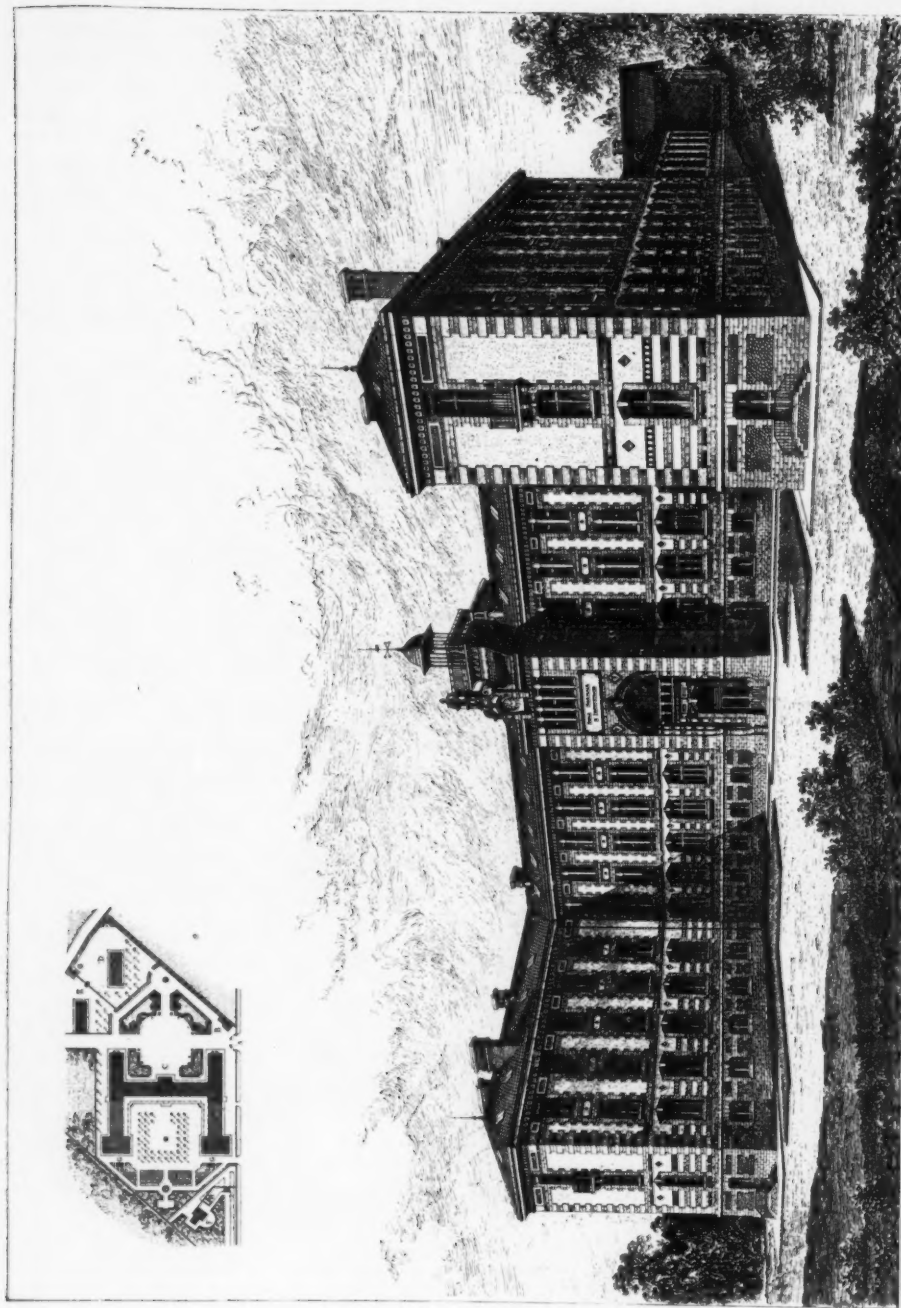
it is possible to provide; and by its use the architect, builder and plasterer are greatly relieved of anxiety and responsibility heretofore attendant upon the uncertainty of the results of plastering; and the owners are assured of good work and saved from costly repairs resulting from the use of chance-mixed, hand-made and half-made wall plaster; while the occupants of houses plastered with their Cement find the walls surrounding them a source of perpetual satisfaction.

As this Cement Dry Plaster is as much superior to common plaster as

genuine hardwoods are to their imitations, it will soon come to be a matter of as much importance with a would-be purchaser of a house to learn if its walls and ceilings are done with this Cement instead of common plaster as it now is for him to know if the wood finish consists of real mahogany, cherry, oak, etc., or only stained imitations of these. But *real* hardwood finish costs *more* than their imitations, while this superior wall cement costs no more than common plaster—which is worth the builder's consideration, though he builds but to sell.

J. B. King.





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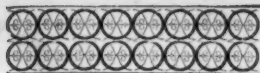
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WITH this number, the SECOND YEAR of THE ARCHITECTURAL RECORD closes. The success of the magazine has been without precedent, a fact which the publishers regard as an indication not only of any merit in their publication, but of the interest which the American public now takes in Architecture. This interest, they are glad to find, is not restricted to the profession, for though there is probably not a single architect, of any standing, in the United States who is not a subscriber to THE ARCHITECTURAL RECORD, several thousand readers are found among the "lay" public, in the Universities, Colleges, Industrial Schools, among artists and the increasing number of the cultured who take an interest in Art.

No effort will be spared, in the coming year, to increase the value of THE ARCHITECTURAL RECORD to these readers.

Our "**Architectural Aberrations**" will be continued. As a companion series, will be added "**Architectural Appreciations.**"

A **History of Architecture** for the lay reader will be commenced in the next number.

The valuable series of papers on **French Cathedrals**, by BARR FERREE, will be continued, with illustrations of most of the great ecclesiastical buildings of France.

Arrangements have been completed for a number of articles by leading architects on the "**Suburban Home.**"

MONTGOMERY SCHUYLER will contribute papers on "**Old Colonial.**"


CHARLES HERBERT MOORE, of Harvard University, will contribute to the Great Architectural Epoch Series—THE GOTHIC PERIOD.

ROBERT KERR, the editor of the recent edition of "Fergusson's Modern Styles of Architecture," will write on the "**Problem of National American Architecture.**"

THE CHURCH OF THE SACRÉ COEUR at Montmartre, Paris, probably the greatest architectural work of recent years in Europe, will be described by its architect, HENRI RAULINE.

The scope of the Magazine will be greatly enlarged to include the decorative arts allied to architecture.

Many other articles that cannot be announced now are in preparation.

 Subscribers should begin with the coming number, Vol. III., No. 1. Subscription, one dollar a year.



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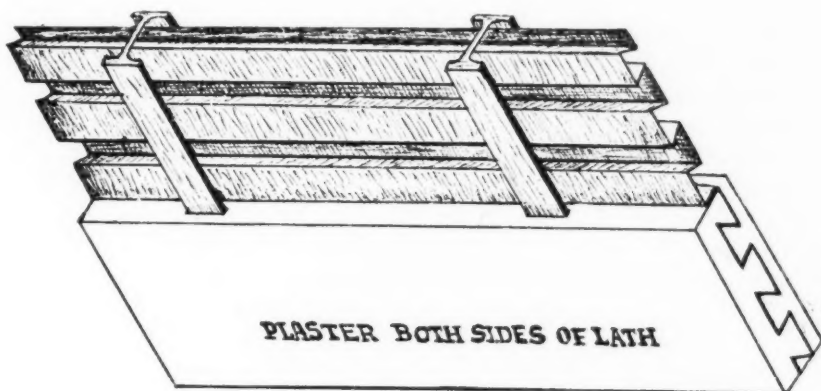


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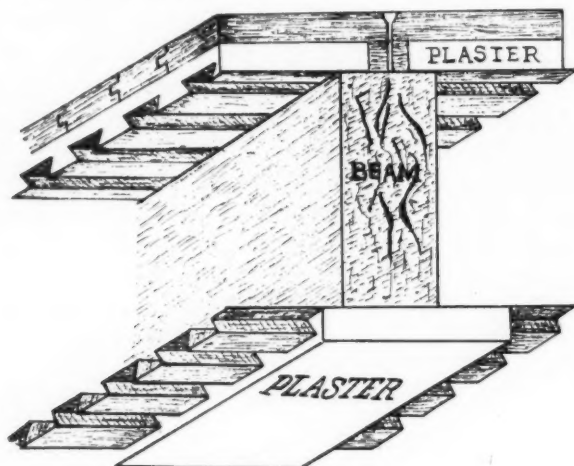
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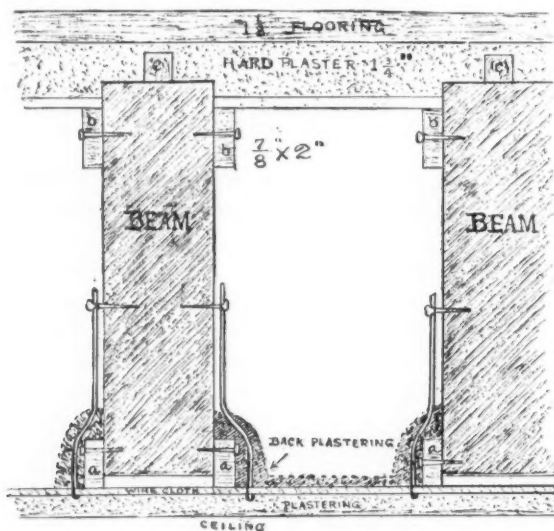


Another use for ROCK PLASTER on metallic lath is for use in casing for staircases, elevator shafts, etc., also for fire-proofing between floors and protecting iron or wooden beams, as shown in cut No. 2.

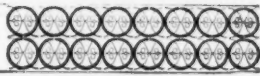
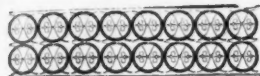


Mr. Moore, who is the President of the Continental Fire Insurance Company, has written a very able work on fire-proof construction, and we are indebted to him for the cuts given.

Metallic lath is placed as shown in the cut, just over and under the beam and is then plastered. Plaster ceiling is applied to the lath from beneath and solid plaster filling plaster to the upper surface nearest the flooring. On this the $1\frac{1}{8}$ -inch tongued and grooved pine floor is placed. Mr. Moore states that this method of construction compared with common construction would command double the ordinary line of insurance at one-third less rates.



In cut No. 3 will be seen further methods of using hard plaster for the protection of beams.



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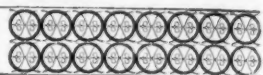
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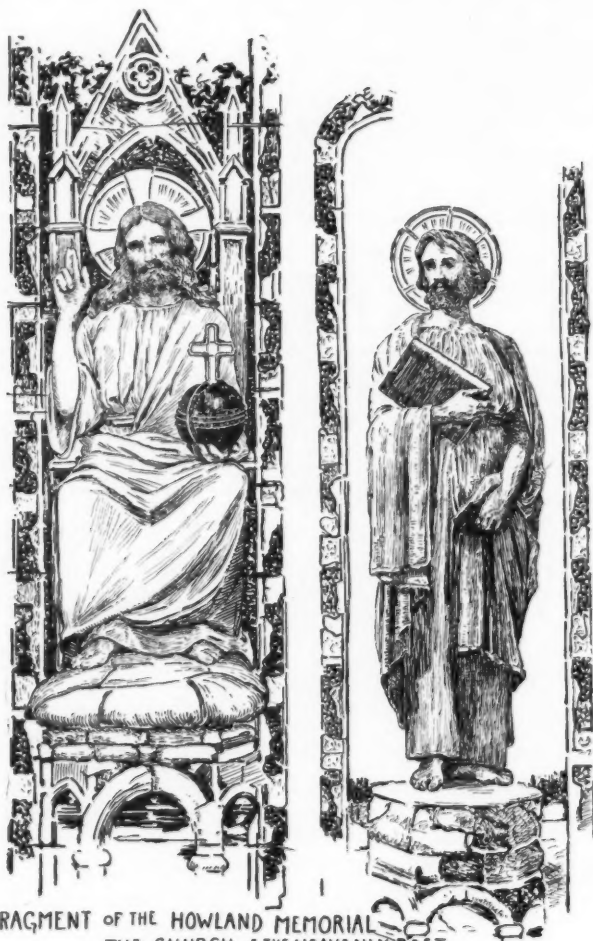
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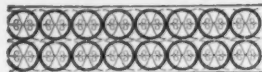
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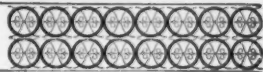
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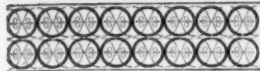
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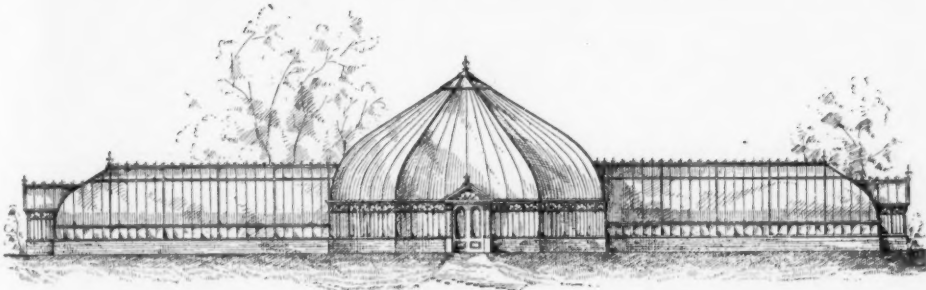


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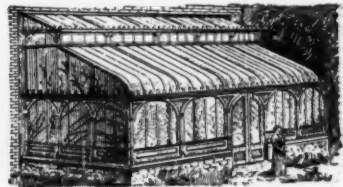
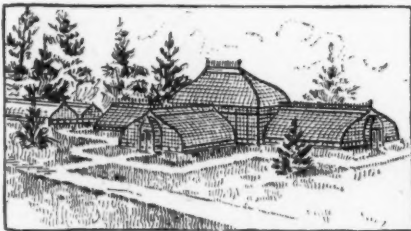
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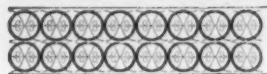


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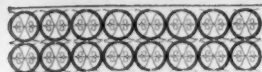
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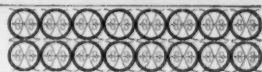
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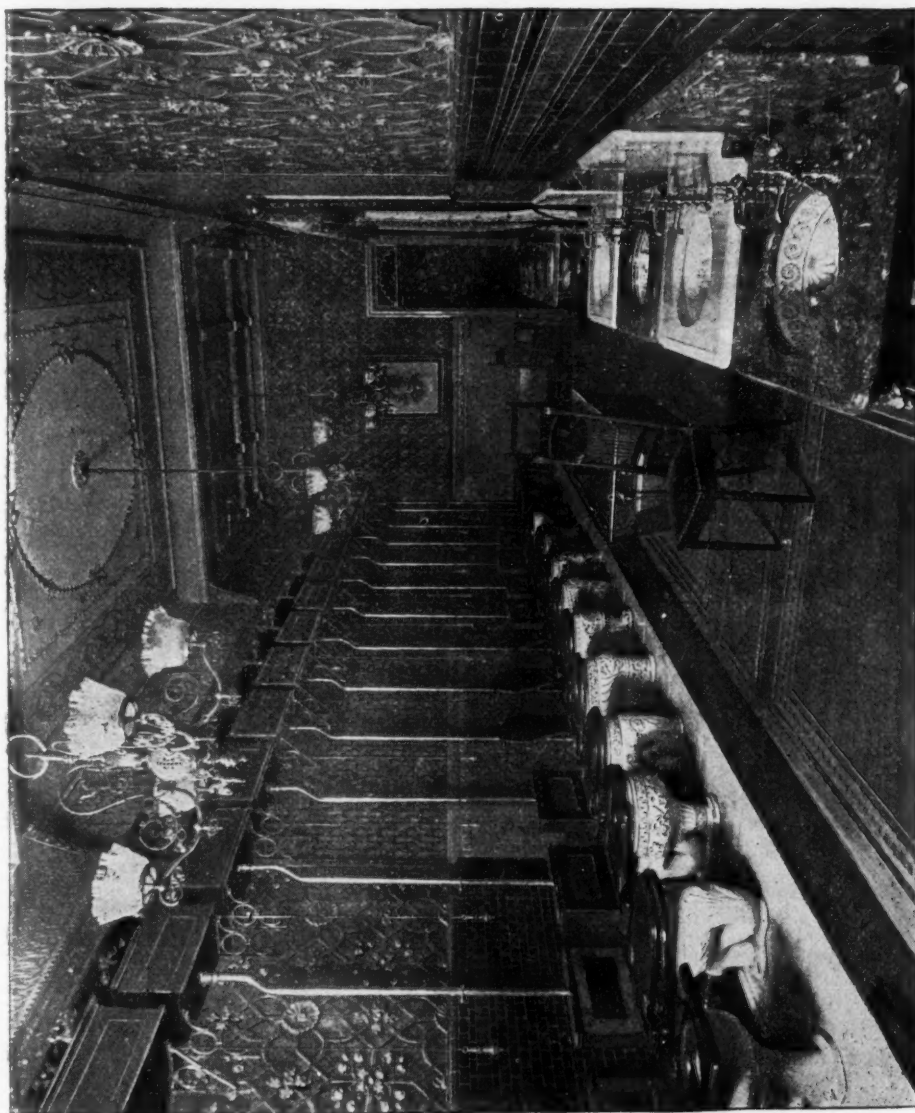
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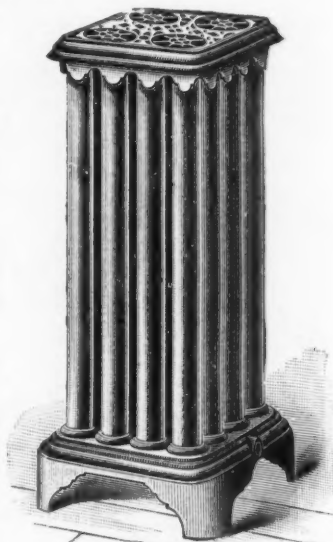
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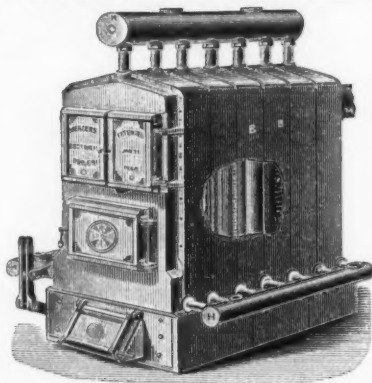
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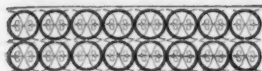
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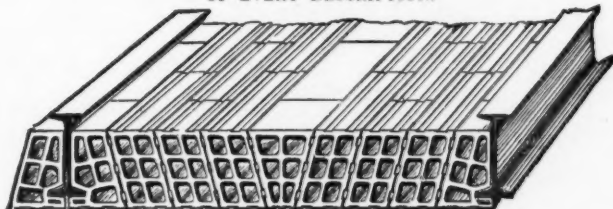
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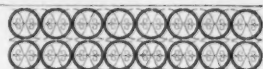
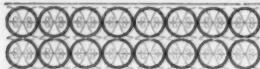
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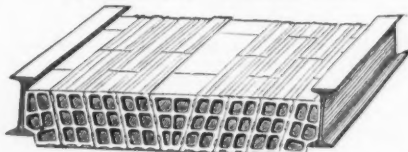
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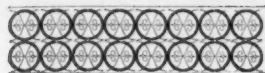
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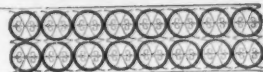
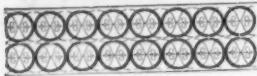
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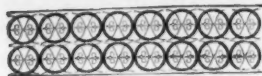
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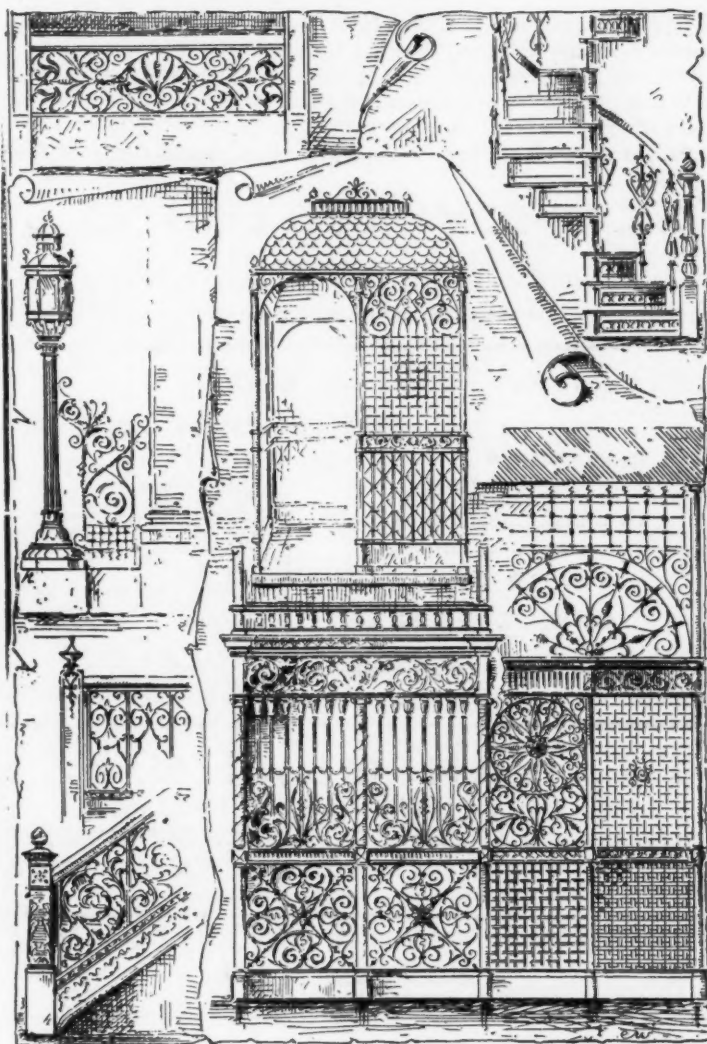
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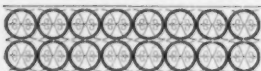
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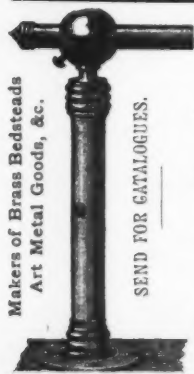
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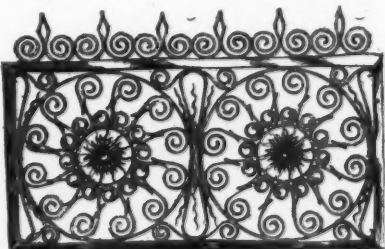
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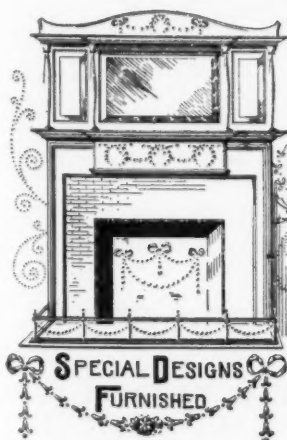
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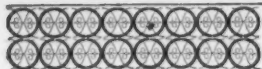
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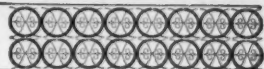
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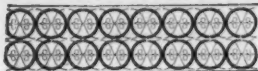
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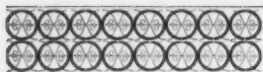
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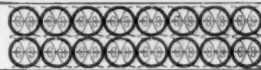
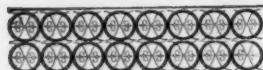
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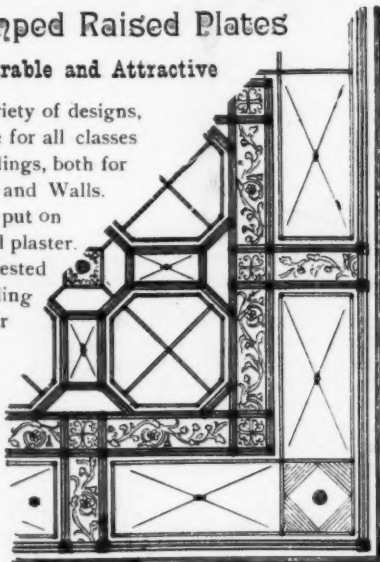
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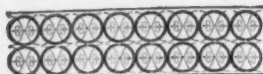
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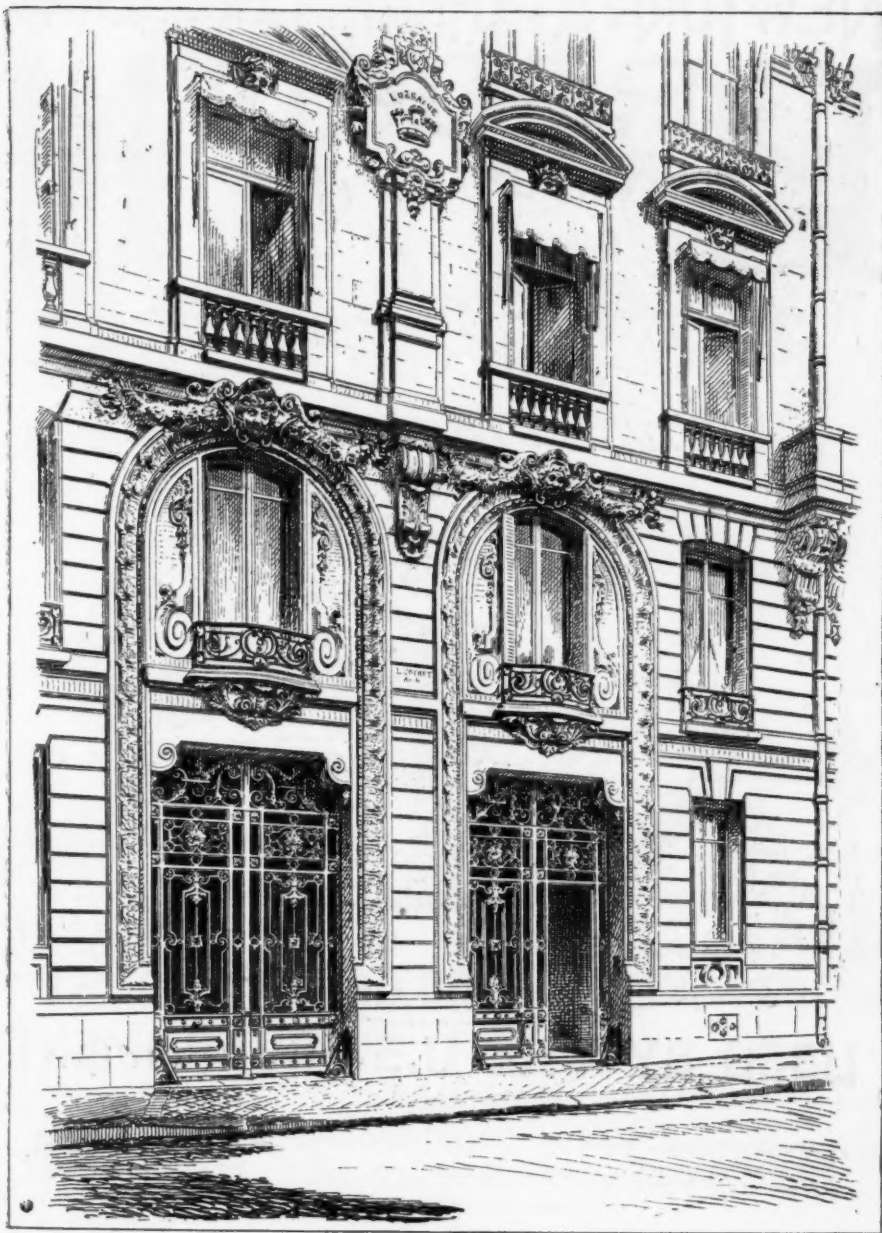
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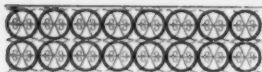
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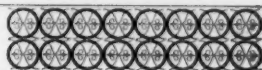
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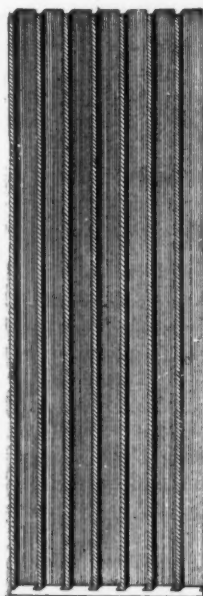
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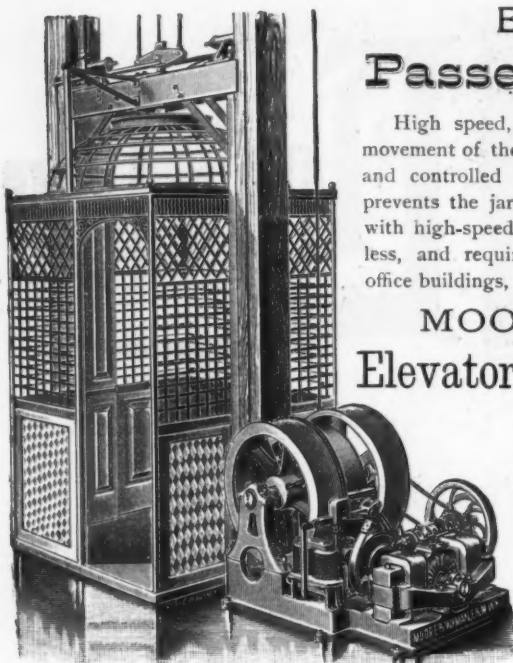
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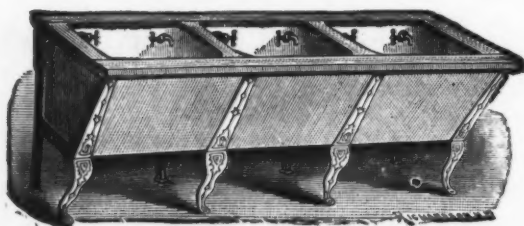
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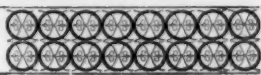
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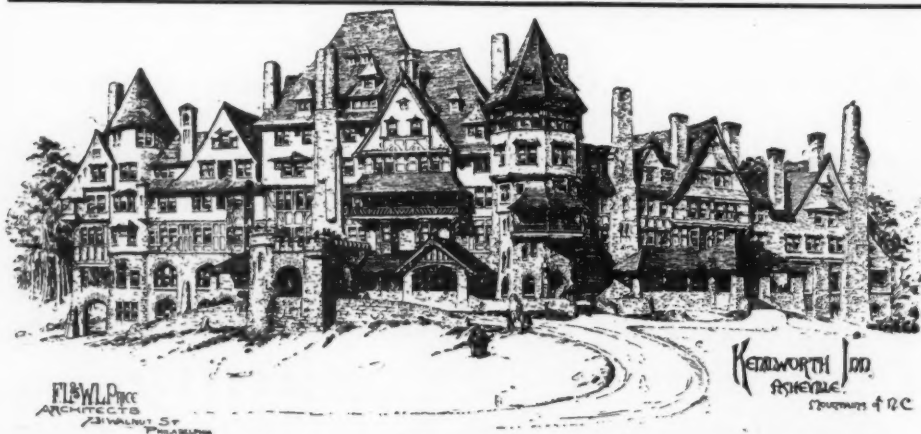


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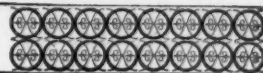
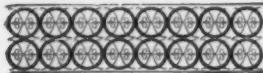
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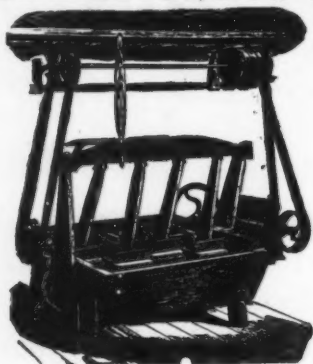
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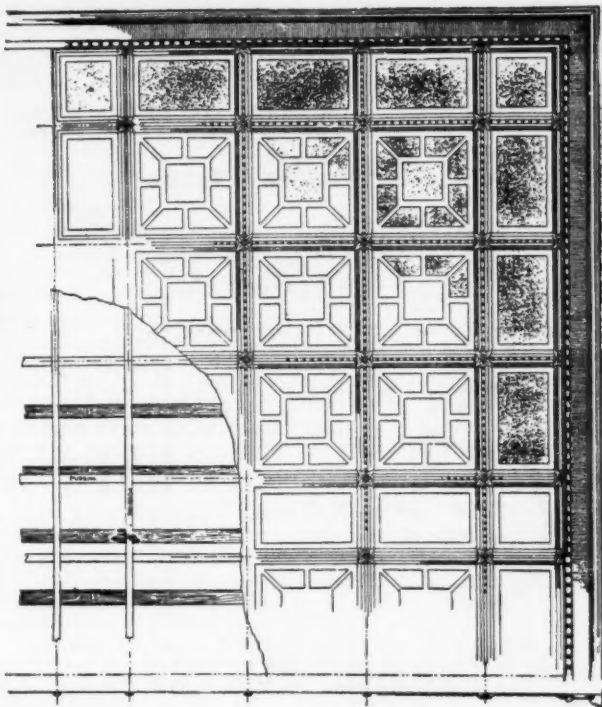
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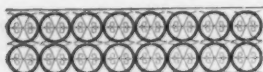
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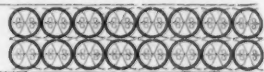
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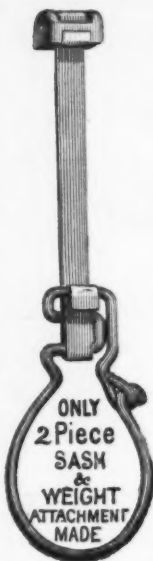


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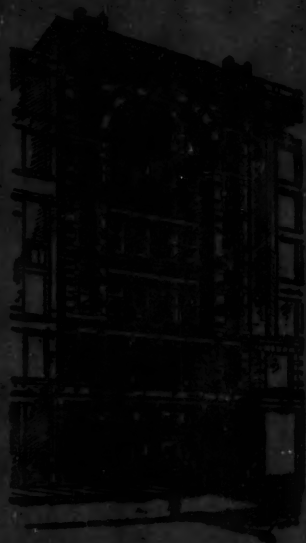
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